NOT TO BE MINISTERED UNTO BUT TO MINISTER
CHRISTIAN MEDICAL COLLEGE
VELLORE
INDIA

SILVER JUBILEE
SOUVENIR

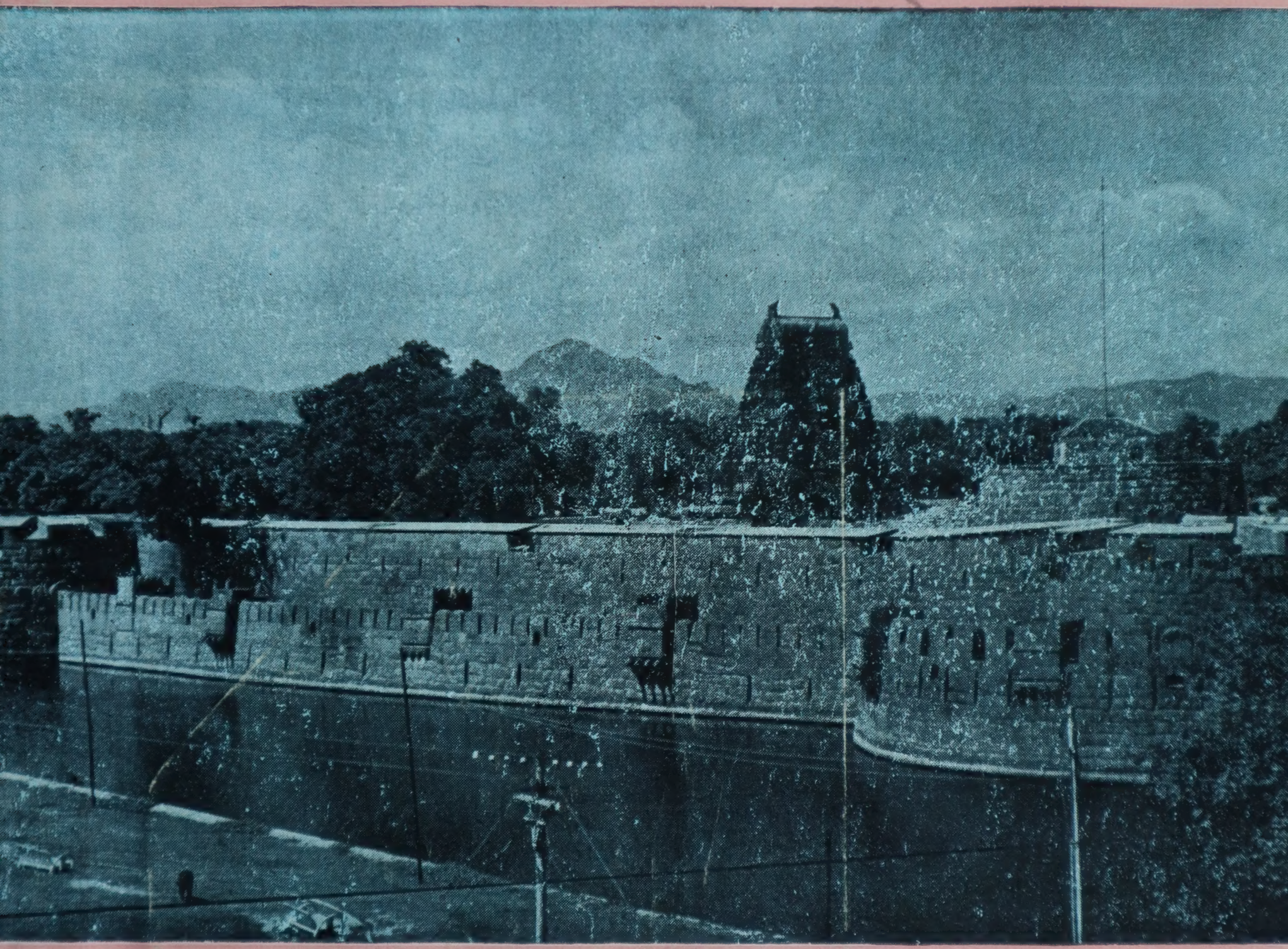
25
1964–1989

Including Abstracts of papers presented at the

VIII ANNUAL CONVENTION OF THE

INDIAN SOCIETY FOR MEDICAL STATISTICS

NOVEMBER 1 — 3, 1990



R(CMC)
(MC)
01821

DEPARTMENT OF BIOSTATISTICS
CHRISTIAN MEDICAL COLLEGE
VELLORE, INDIA

01821

With best compliments from

Telex : 041 6969 SISC IN
Grams : SYRINGE

Phone : 568663/4/5/6
Fax : 91-44-560382

THE SOUTH INDIA SURGICAL CO. PVT. LTD.

OVER 45 ERY
MANU

850, M

FOREWORD

The Department of Biostatistics, Christian Medical College, Vellore has acquired a unique and prestigious position in Biostatistical education, research and consultancy service. Today we celebrate the Silver Jubilee of this Department which marks a major milestone in its development as each year presented new opportunities to make progress. The chain of activities performed by all the staff members during the past few months with great enthusiasm has led to the successful celebration of this event. On this occasion, the Department is entering a new era for further development.

We take this opportunity to thank all those who have contributed to the growth of this department. We are grateful to all those who helped in the release of this Souvenir, especially :

those who have sent in messages of good will;
the advertisers and well-wishers for their financial help;
those who have contributed articles;

the staff members for collecting advertisements and
the printers, M/s. A H. Press, Vellore for bringing out this Souvenir in time.

Above all, we thank God Almighty, the fountain and source of all knowledge and wisdom, for being with us in all our efforts.

Vellore-632 002
October 31, 1990

Organisers
Silver Jubilee Committees
Department of Biostatistics
Christian Medical College

01821

MP-100

COMMUNITY HEALTH CELL
326, V Main, I Block
Koramangala
Bangalore-560034
India

SILVER JUBILEE CELEBRATIONS OF
DEPARTMENT OF BIOSTATISTICS

October 31, 1990

VIII ANNUAL CONVENTION OF THE
INDIAN SOCIETY FOR MEDICAL STATISTICS

November 1 — 3, 1990

ORGANISING COMMITTEE

Dr. A. Gnanam (Chairman)
Vice Chancellor
Madras University

Dr. B. M. Pulimood (Member)
Director, C.M.C.H.

Dr. B. V. Moses (Member)
Principal, C.M.C.

Dr. P. S. S. Sundar Rao (Member)
Head, Dept. of Biostatistics, C.M.C.

Dr. K. N. Ponnusamy (Member)
Head, Dept. of Statistics,
Madras University

Dr. J. Richard (Organising Secretary)
Assoc. Prof., Dept. of Biostatistics, C.M.C.

Dr. L. Jeyaseelan (Joint Organising Secretary)
Lecturer, Dept. of Biostatistics, C.M.C.

Mr. K. G. Selvaraj (Treasurer)
Lecturer, Dept. of Biostatistics, C.M.C.

Reception & Registration Committee

Dr. M. Lakshmanudu (Convener)
Mr. J. Arokiasamy
Mr. S. Selvaraj
Mr. Upendra
Ms. R. Mercy Arunmozhi
Ms. D. Aruna
Ms. M. Padmavathi
Ms. Mercy
Ms. Binitha

Transport and Accommodation Committee

Mr. B. Antonisamy (Convener)
Mr. Jebaraj Daniel
Mr. Balu
Mr. M. Baskaran
Mr. L. Jeyaseela Selvanathan

Scientific Programme Committee

Dr. L. Jeyaseelan (Convener)
Mr. P. Marimuthu
Mr. David Selva Pandian
Ms. G. Padma Vasanthakumari
Mr. V. Swaminathan
Mr. J. L. Samuel
Mr. A. Divianathan
Mr. A. Amalraj
Mr. A. Sakthivelusamy

Catering Committee

Mr. Lalith Kumar Samuel (Convener)
Ms. A. K. Mary
Mr. V. P. Natarajan
Mr. John Kennedy
Ms. Adeline Royal

Cultural Programme Committee

Mrs. Ratna Prakash (Convener)
Mr. Nagendra Prakash
Ms. G. Rupavathy
Mr. Maran

Travel and Tours Committee

Dr. K. N. Subramaniam (Convener)
Mr. D. Devaraj

Souvenir Committee

Mr. S Muthurathnam (Convener)
Mr. E. Joseph Alexander
Mr. R. Samuel Sargunar

Secretarial Assistance

Mr. V. Krishnan
Mr. K. Sekar
Mr. D. Balaji

Publicity Committee

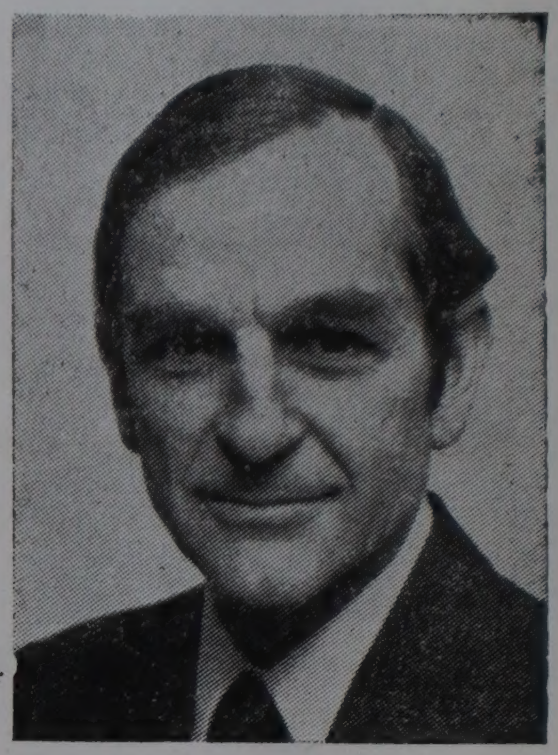
Mr. M. Irudayaraj (Convener)
Dr. A. Chandrasekar
Mr. M. Jayaraj
Mr. S. Selvakumar

UNIVERSITY OF LONDON

INSTITUTE OF CHILD HEALTH

The Hospital For Sick Children

Great Ormond Street



JOHN K.G.WEBB, O.B.E., M A., B.M., F.R.C.P.
(Emeritus Professor, Newcastle)
TROPICAL CHILD HEALTH UNIT

Langford Downs House,
Lechlade, Glos.
GL7 3QJ

MESSAGE

The Department of Biostatistics has, from its earliest days, been a specialist resource of the greatest value to all sections of Christian Medical College & Hospital. The Department's roles in teaching and in its own epidemiological research have been distinguished, but the ready way in which its statistical and computer expertise has been available to all has been invaluable.

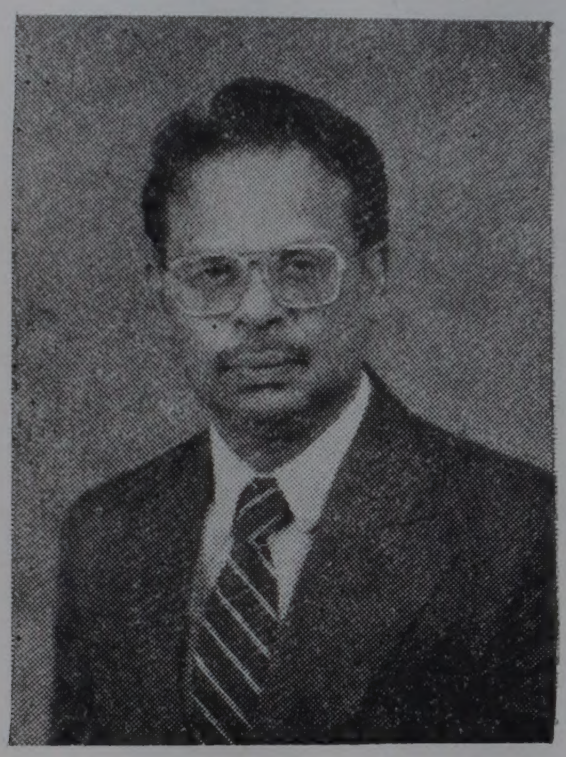
I am glad to have this opportunity to express my appreciation of this service and specifically of the advice and help given by Dr. Sundar Rao and his colleagues to me both as Paediatrician and Director. The Department deserves the respect and gratitude of the whole institution. I am happy to share with them in this celebration of their Silver Jubilee, and to wish them well for the future.

— John K.G. Webb

The Lutheran Christian Health and Medical Centre

AMBUR - 635 802 N.A.A.District South India

Dr. A. S. FENN, M.S., F.A.C.S., F.I.C.A.
Director



MESSAGE

I am extremely happy to know that the first Department of Biostatistics in India was started in 1964 at the Christian Medical College, Vellore, and the department has completed 25 years.

I have always been impressed by the work turned out by the Biostatistics department, especially under your leadership and the help the department has provided to the various clinical units in preparation of their papers. We have also appreciated the classes you have taken to introduce the fundamentals of statistics to our postgraduate students.

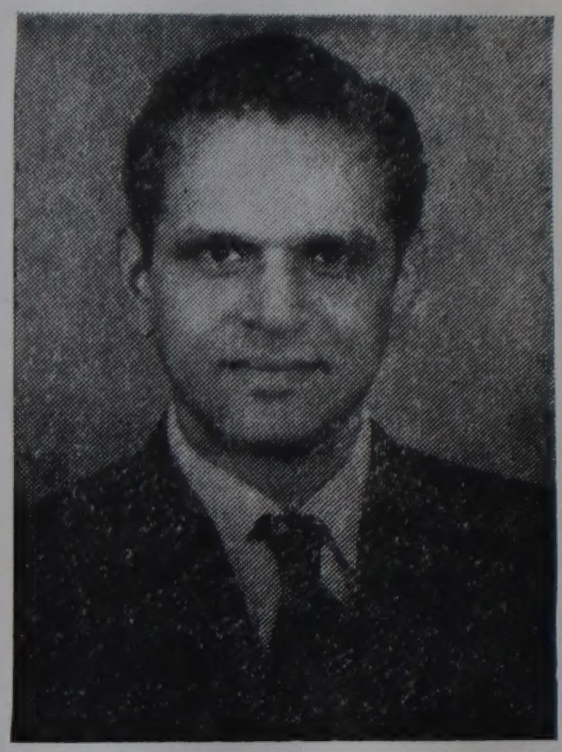
I would like to take this opportunity to wish the Silver Jubilee Celebrations all success and many more years of useful service by the department in future.

-A. S. Fenn

CHRISTIAN MEDICAL COLLEGE & HOSPITAL

VELLORE-632004, S. INDIA

Dr. B.M. Pulimood, MBBS., FRCP, (EDIN)
Director



MESSAGE

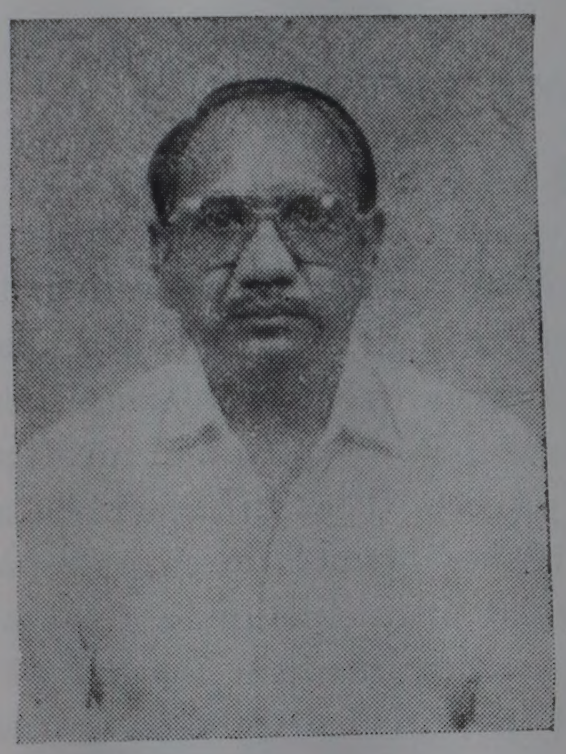
The Department of Biostatistics is celebrating its Silver Jubilee this year. For a Medical College in India, this may be one of the first departments which has been established. The department is well staffed and involved in a number of important projects. The Christian Medical College on the average publishes about 100 scientific papers per year. If you make a calculation, a total of 2500publications would have been made in the last 25 years. The Department of Biostatistics would have been consulted on some aspect or the other of atleast 50 percent of these publications. On the average this Institution has 60–70 projects which are on-going. Many of them supported by Departments of Science and Technology, Indian Council of Medical Research, Indian Council of Scientific and Social Research, Atomic Energy Commission, Ford Foundation, World Health Organisation, The Rockefeller Foundation, and other major Foundations interested in medical research. These projects are certainly important scientific work recognised all over the world. Thus the department had been a major support for the Scientific contribution of this Institution for the last three decades. A special mention need to be made of Dr. P.S.S. Sundar Rao, who had the distinction of obtaining a Ph.D., in 1976 and Dr. J. Richard, a Ph.D., in 1980. Their work in various aspects in population studies in North Arcot District is a unique contribution by these two people, and is a wealth of scientific knowledge and contribution for the country and rest of the world. The efforts of these two pioneers have resulted in establishing the unique M.Sc., Course in Biostatistics, under the University of Madras for the first time in academic history of this country. Head of Biostatistics Department is Ex-officio member of the Research Committee, and had been elected as Secretary almost every year since I had been associated with the Committee from 1972. As such department is in leadership role in research administration in the Institution. The staff of the Department are actively involved with a number of Institutions and Organisations in the country who are in leading role in research in their own fields.

I would like to thank God for the achievements of this Department. We wish all the best for their Silver Jubilee celebrations.

-B. M. Pulimood

Office of the Principal

Christian Medical College
VELLORE-2.



MESSAGE

I consider it a great honour and privilege to write these few lines on the occasion of the celebrations of Silver Jubilee of Biostatistics Department. Biostatistics Department was started by Dr. P.S.S. Sundar Rao in 1964 in Christian Medical College, Vellore and today it is a large department with well qualified faculty and a large number of Research Workers.

Biostatistics Department under the able guidance of Dr. P.S.S. Sundar Rao was involved in Research in Collaboration with many Departments. Among them are Longitudinal Studies in Reproduction in a population of 1,00,000 scanning 3 generations. Biostatistics Department stands first in many areas, first to offer M.Sc., in Biostatistics in whole of India, Doctoral Programmes; they introduced Computer in C.M.C. and founder member of E R.C. The Department is actively involved in helping many departments in their research.

I wish this Department will grow from strength to strength, enriching the research in C.M.C. I pray for the Lord's richest blessing on this Department and its dedicated Staff.

- Baaskaran Vasanthakumar Moses

Principal.

CHRISTIAN MEDICAL ASSOCIATION OF INDIA

Plot No. 2, Local Shopping Centre,
Janakpuri, New Delhi-110058

MESSAGE

I was happy to get your letter of 21-9-90 and have information on the VIII Annual Convention of Indian Society for Medical Statistics 1 -3 Nov. 1990. I was also pleased to hear that your Department has completed 25 years of service.

On this occasion I send you greetings on behalf of the CMAI network. It is not often that we realise the value of medical statistics and the ways your discipline can help us in the hospital and community. We in CMAI appreciate your work, leadership and contribution to our members in different ways. I am glad we have been associated with the publication of your text book and on various studies on the state of our institutes. You have been a member of our Projects committee and now our Board. At this time let us give thanks to God for the way your department has grown, contributed and challenged so many. We wish you all well.

May your Conference and Silver Jubilee celebrations be a success and may you continue to give direction to this important field in our country.

- Daleep S. Mukarji
General Secretary

Dr. L. RAMACHANDRAN,
M.B. B.S., D P.H , D.I.P.H., F.A.M.S.
Central Health Service (Retd)

"SHOBANA"
Sri Ramar Colony,
DINDIGUL-624009

MESSAGE

Vital statistics are vital for planning, implementation and evaluation of medical care and health services. Though we have witnessed tremendous advances in medicine and public health in the country in the past few decades, it has to be admitted that our health information system leaves much to be desired. Having been involved in the evaluation of health programmes in the different parts of the country in the remote past as well as recently, I can make a candid statement that recording of events and maintenance of records are very poor not only in the Primary Health Centres but also in most of the hospitals. Though there is sufficient man-power resource available in the health care system it has not been geared properly for prompt and accurate recording of vital events and service statistics with the result there is still dependence on mere estimates for important vital rates and also for the magnitude of many health problems. Epidemiology is based on various disciplines among which Biostatistics is highly important.

Under these circumstances it is of good augury that the Eighth Annual Convention of the Indian Society for Medical Statistics and Seminars on Biostatistical Methods in Clinical Epidemiology Information System for Child Survival and Safe Motherhood are being held shortly at CMC, Vellore. I am sure that there will be focussed deliberation on the ways and means of involving the existing health infra-structure in the generation and maintenance of data of good quality to lessen the dependence on decennial census data and sample registration schemes of the Registrar General's office.

I wish the convention of the Indian Society for Medical Statistics every success in its endeavour.

-L. Ramachandran

The Christian Medical College and Hospital, Vellore
A historical sketch

Now large and well known, the Christian Medical College and Hospital (C.M.C. as it is popularly known) was started in 1900 as a one-bed clinic by Dr.Ida Sophia Scudder, a young American Missionary, in response to a dramatic encounter with the suffering of Indian women.

One eventful night before the turn of the century, Ida then a young girl visiting her missionary parents in South India was asked to help three women from different families struggling in difficult childbirth. Custom prevented them from accepting the help of a male doctor and being without training at that time Ida herself could do nothing. The next morning she was shocked to learn that each of these women had died. She believed that it was a calling and a challenge set before her by God to being a ministry to the health needs of the people of India, particularly women and children.

Consequently, she went back to America, entered medical training and in 1899 was one of the first women graduates of the Cornell Medical College, USA. Shortly thereafter, she returned to India and opened a one-bed clinic in Vellore in 1900. Two years later in 1902, she built the 40-bed Mary Taber Schell Memorial Hospital the forerunner of today's large, well-known, well equipped 1240 bed medical centre, which was moved to its present site in 1924, when the work expanded.

Dr.Ida S.Scudder soon realised that the dire need around her was far greater than what one person could meet. She was convinced that the best way to help the women of India was to train Indian women to serve them. She began in 1903 by teaching several compounders and six years later in 1909, she started the School of Nursing. Her fondest dream came into being a medical school for women in 1918 which trained licentiates in medicine. It became a Medical College in 1942 through her determined efforts and men were admitted from 1947.

C.M.C.'s services have since grown rapidly. Many specialities came into being and the number of postgraduate courses increased. Today C.M.C. offers 90 recognised training programmes in medical, nursing and paramedical fields.

The earliest vision of Dr.Ida S.Scudder also included a primary concern for the poor and the neglected sufferers. She went to outlying villages, taking medical care to the doorstep of those lacking access to health care, beginning C.M.C.'s first "Roadside" dispensaries in 1906.

Extensive rural health and development programmes replaced her initial "Roadsides". The call to reach out to need beyond the doors of the main Hospital continues to be a major emphasis of many specialised Departments of C.M.C.

The Christian Medical College and Hospital has come to occupy a prominent place among the Medical Institutions in India. CMC is unique in being both a centre which gives attention to the needs of the disadvantaged, taking health care to their doorstep and a leading referral hospital offering tertiary care using the latest in technology. C.M.C. believes in the wholeness of healing and tries to integrate health care and spiritual nurture.

The combination of technical competence and the urge to be relevant to the needs of the environment in which C.M.C. is placed has given rise to a wide range of research and developmental activity.

C.M.C.'s principal achievement lies in the lives of hundreds of health personnel who having studied and worked here, have imbibed the spirit of compassionate competence. Our present staff of doctors, nurses and other workers are an inspiration to all.

Today C.M.C.'s graduates form a large number of trained health personnel for Christian Medical work all over India. C.M.C. is considered a significant healing arm of the Christian Churches of India.

Throughout its history C.M.C. has taken up each new task in response to Christ's command. In the words of our founder, Dr.Ida Sophia Scudder, "We thank God for the way He has led us in the past and look forward to an even greater future."

Today there are 1240 beds for inpatients and on an average 2000 outpatients are treated daily. Extensions of CMC & H include Schell Eye Hospital, Mental Health Centre, Rehabilitation Centre for leprosy patients, and rehabilitation institute for the disabled. Besides these the CHAD and RUHSA units serve the rural areas surrounding Vellore. ❑

Dr. Ida S. Scudder and Mr. P. S. S. Sundar Rao

TRAINING PROGRAMMES AT CHRISTIAN MEDICAL COLLEGE, VELLORE

A Brief Description

The Christian Medical College was founded by Dr.Ida S.Scudder (popularly known as Aunt Ida) the daughter of a medical missionary. Realizing the need for women doctors in the country, Aunt Ida obtained her medical training in the United States and returned to India. She started the Christian Medical School in 1918 for training women students for the Licentiate Diploma (L.M.P.). She was the first Principal and her first batch of medical students achieved a 100 per cent pass in the University Examinations. In 1942, the medical school was raised to the status of a College and the first batch of 25 students was admitted to the M.B.B.S. Course. Men students were admitted since 1947. Permanent affiliation to the University was obtained in 1950. At present sixty students are admitted annually to the MBBS Course.

The first post graduate trainees were admitted in 1950 in the MD (General Medicine) and MS (General Surgery) Courses. At present, there are diploma courses in 12 different specialities and post graduate degree courses in 24 different specialities. The Medical College now trains post-graduates from all over India in General Medicine, General Surgery, Pathology, Physiology, Anatomy, Pharmacology, Paediatrics, Radiodiagnosis, Radiotherapy, Anaesthesiology, Biochemistry, Oto-Rhino-Laryngoloy, Orthopaedics, Neurology, Cardiology, Thoracic Surgery, Neuro Surgery, Genito-Urinary Surgery, Nephrology, Gastroenterology, Ophthalmology, Obstetrics and Gynaecology, Clinical Pathology, Psychiatry and Dermatology. Non-medical post-graduate courses are also offered in Anatomy, Physiology, Biochemistry, Pharmacology, Microbiology and Biostatistics. This institution has been a pioneer in India in the development of higher specialities like Cardiology, Psychiatry, Thoracic Surgery, Neurology, Neurosurgery, Urology, Nephrology, Endocrinology and Gastroenterology. There are also paramedical training courses in Pharmacy, Physiotherapy, Occupational Therapy and Medical Records. CMC has followed the policy of pursuing high technical excellence and skill in specialised fields and at the same time making them available to increasing numbers of the poor, a policy fully endorsed by expert international groups which reviewed the work of CMC recently. The College is now supported by 76 churches and organisations in India and abroad, and is administered by a council in India consisting of their representatives.

Ida Scudder gave to the institution as its motto the phrase, "Not to be ministered unto but to minister" for she wanted men and women to be trained to serve in the spirit of Christ, with compassion and with concern for the whole person.

The College is a Christian institution whose aim as quoted from the Memorandum of the Association of the College is "The establishment, maintenance and development of a Christian Medical College, where men and women may receive an education of the highest grade in the art and science of medicine and of nursing, to equip them in the spirit of Christ for service in the relief of suffering and the promotion of health; in particular in obedience to the spirit of Christ to provide for the full recognition of the moral and spiritual basis of life in relation to health."

The aim is not just to conform to the minimum standards required for a medical college, but to give leadership in research, service in rural areas, the moral and spiritual basis of healthful living and to develop a quality of character and attitude to the sick and the suffering which would be Christ like. Thus it is recognised that the mark of faithfulness to Christ is an obligation to develop medical care characterised by excellence and concern for the needy.

The primary task of the Christian Medical College is to train doctors & health professionals in the spirit of Christ for service in the relief of suffering and promotion of health. Keeping in mind this important objective, the students have a responsibil-

ity to develop a sense of commitment to accept this challenge and be prepared to go and work in small hospitals throughout the country, if they are called upon to do so.

Another major activity is research in a number of health related areas. The evolution of research here has been oriented to recognised areas of need in India. While many of the research projects use advanced techniques and complicated equipment, among them are a number of examples of emphasis on their application to appropriate and relevant problems. Some of these have been of exceptional value in combating diseases and major health problems such as leprosy and diarroea in children.

In 1984 CMC launched a new continuing Medical Education Programme for its alumni and other medical graduates engaged in busy general practice singly or in remote areas. The need for this kind of a 'distance learning' update was long felt and was being met to some extent by the short annual refresher courses conducted at CMC for the last two decades.

The National Academy of Medical Sciences has commended this venture of CMC's as the only long term programme for general practitioners in the country. ❑

MILESTONES

1955 • The first appointment of a statistician in C.M.C. (Mr.P.S.S. Sundar Rao)

1956 • Lectures in Biostatistics began for I clinical year students
• The first mechanical calculator (hand-operated Facit) introduced at CMC.

1957 • Biostatistics classes for Medical Record Officer trainees

1958 • Course on Biostatistics for first year pre-professionals (I MBBS) started

1961 • The appointment of two additional statisticians (Mr.J.Richard and Mr.G.Jesudian)

1964 • Establishment of the Department of Biostatistics
• The first ever household survey of Vellore town

1965 • Planning for surveys undertaken by Leprosy research unit at Karigiri
• Biostatistics classes for B.Sc. (Nursing)

1966 • Establishment of ICL Data Processing Unit
• First research project of the Dept. of Biostatistics - "Methods of evaluation of primary health centres," supported by ICMR

1968 • Epidemiological studies on epilepsy and stroke in Vellore and K.V.Kuppam
• Utilization of IBM 370 computer at IIT, Madras for data processing

1969 • Launching longitudinal studies in human reproduction
• Starting of Biostatistics and Research Methods classes for M.Sc. (Nursing)

1970 • Research project on "Patterns of Health expenditures."

1971 • Publication of the first monograph from Longitudinal Studies in Human Reproduction

1972 • Biostatistics classes for Diploma in Hospital Administration

1973 • Monograph on patterns of Health expenditure

1975 • Special training in Biostatistical methods for I MBBS students attending Community Orientation Programme

1977 • ICMR Research study on the effects of prenatal factors on development during the first 7 years of life
• Recognition of the Department of Biostatistics for guiding Ph.D. students

1978 • Publication of the manual, "An Introduction to Biostatistics" (First edition)
• ICSSR study on Socio-economic and demographic correlates of medical care utilization

1980 • Diploma course in Health Statistics

1981 • ICMR multicentric project on protein energy malnutrition with reference to growth, development and morbidity in children

1983 • Publication of the second edition of "An Introduction to Biostatistics"

1984 • The Department became a founder-member of Epidemiology Resource Centre (ERC)

1985 • United Nations Population Council's prospective study on the determinants of female age at marriage

1986 • Longitudinal studies on growth and development during adolescence
• Utilization of microcomputers installed at ERC
• M.Sc. course in Biostatistics started

1988 • The first batch of M.Sc. Biostatistics awarded degree
• The first candidate awarded Ph.D. in Biostatistics (Mr.L.Jeyaseelan)

1989 • Longitudinal studies on child growth and development (sponsored by National Centre for Health Statistics, U.S.A.)

DEPARTMENT OF BIOSTATISTICS
A BRIEF DESCRIPTION

The Department of Biostatistics was formally organized in 1964. Prior to that Dr.P.S.S.Sundar Rao (in 1955) and Mr.G.Jesudian and Dr.J.Richard (in 1961) were appointed in the Department of Preventive and Social Medicine to primarily assist in statistical aspects of the department's research in Nutrition and Family Planning.

At present there are 11 permanent staff in the Department. Apart from those 50 staff are working in various research projects undertaken by the Department.

The various activities of the Department may be broadly classified under 3 categories, as explained below in detail:

I. Service

The Department continues its strong support to the programmes in the Department of Community Health including the Community Orientation Programmes (COP) which involve the medical students in studying demographic, socio-economic and health status of the rural community. In fact it was the Biostatistics practical classes that were held in the communities that led to the establishment of the present COP.

The services of the Department are also utilized by all other clinical departments in conducting clinical trials, instituting retrospective and prospective follow-up studies as well as in the assessment of diagnostic efficacies of various procedures. In addition to serving all departments within Christian Medical College and Hospital, the Department also assists sister institutions. Most departments in Schieffelin Leprosy Research and Training Centre (SLR & TC) located at Karigiri utilize the statistical services of the Department in a variety of research and service activities including demographic surveys of Gudiyatham Taluk, assessment of incidence and prevalence of leprosy, study on contacts of leprosy cases and the evaluation of Multi Drug Therapy (MDT).

The Department also renders its services to individual staff in preparation of research papers for publication or presentation at conferences.

The Department assists this institution in selection of all undergraduate and post graduate medical and nursing students as well as for the paramedical courses. Required guidance and assistance are provided during various stages of the selection process namely, registration of applications, conducting the written tests, valuation of answer sheets, preparation of lists and tables necessary for the selection committee and item analysis of the responses of the candidates.

II. Research activities

Right from its inception in 1964, the Department of Biostatistics, laid a strong foundation for its research activities by focussing on the demographic aspects of the headquarters town, Vellore. The population of this town doubled itself from 50210 in 1921 to 106603 in 1951 as revealed by the census enumeration. Apart from such general information it was felt necessary for many purposes especially for medical research, to get a more specific picture and a frame work by conducting an intensive survey of Vellore town. This survey popularly known as "Household Survey of Vellore Town" was undertaken by the Department of Biostatistics, during 1964-65. It covered the entire town consisting of 25994 families with a total population of 127075. This study revealed not only a mere population count but also many useful demographic and socio-economic characteristics of the inhabitants of Vellore. From 1966 onwards, several research projects have been carried out by the Department of Biostatistics in Vellore town and adjoining rural areas of North Arcot District. A brief description of these projects follows highlighting their objectives.

A study on methods of evaluation of Primary Health Centres, sponsored by ICMR was carried out during 1966-69.

Realising the need for eradication of leprosy, studies supported by Swedish Red Cross, U.S. Department of Health, Education, and Welfare examined the epidemiological aspects of leprosy during 1966-70.

In order to fulfill the needs of reliable statistics on the prevalence and pattern of epilepsy and stroke an epidemiological survey was carried out on behalf of the Department of Neurological Sciences from March 1968 to December 1968, covering a total population of 2,58,576.

A study on patterns of health expenditure was carried out during 1970-73 with the financial aid from Indian Council of Medical Research. During 1978-80, a research study sponsored by Indian Council of Social Sciences Research was carried out to examine the socio-economic and demographic correlates of medical care utilization and health behaviour.

A unique five-year longitudinal study, the first of its kind in India, founded by National Center for Health Statistics, USA was launched in 1969 to investigate the interaction of gestational age and birthweight, and its relation to infant mortality and the incidence of congenital defects; to sutdy maternal blood pressures before and during pregnancy, and its relation to toxaemias of pregnancy; and to study the relationship of consanguineous marriages to the continuation of pregnancy, infant mortality, the incidence of congenital defects, and the gestational age and birthweight of the child. These studies revealed many useful findings regarding the effect of inbreeding on maternal and child morbidity and mortality. These findings were published in thirteen research monographs and several articles.

Conclusions from this longitudinal study were based on the follow up data relating to 14243 pregnancies. The babies registered in this study formed the cohort for another longitudinal, ICMR-supported study during 1977-80, in order to examine the effects of prenatal factors on development during the first 7 years of life. ICMR continued its support for a further longitudinal study of the same cohort, during 1981-85, to examine the protein energy malnutrition and growth, development and morbidity pattern in children. At the end of this project, this cohort was 16 years old (born in 1969).

This cohort was followed up for a three year study from 1985, sponsored by Population Council, New York, to investigate the determinants of female age at marriage. The same cohort with additional inputs is presently followed up to examine the inter-generational changes in maternal health and child growth and development. This five-year project, launched in 1989 under the sponsorship of National Centre for Health Statistics, USA, utilizing the data base formed from 1969 spanning over 3 generations, has a unique place in bio-medical research in Inida and the data base created is indeed an invaluable asset for many biomedical research investigations. Another longitudinal study of five years' duration aiming to assess the growth and development of children during adolescence, is also in progress now.

The Department of Biostatistics, in addition to its own research projects, has assisted many other departments of Christian Medical College, Vellore and sister institutions in studies on Nutritional Diseases, Fertility and Contraception, peptic ulcer, leprosy, deafness, CNS and CVS disorders, Primary Health Care and Schizophrenia.

More than 200 articles have been published so far, with staff members of the Department of Biostatistics as the main authors or co-authors. Apart form this, the staff members of the Department participate in various conferences held in India and abroad and present papers on topics releated to medicine, public health and demography.

III. Teaching Programmes

Christian Medical College, Vellore is probably one of the very few medical colleges in India offering courses in Biostatistics, Demography, and Research Methods including Epidemiological thinking to medical students from 1957. From the beginning, lecture notes and handouts were prepared and distributed liberally, since there were hardly any good texts available. Subsequently, a Biostatistics Manual was produced in 1978 which soon became highly popular not only within the institution for medical students, but also for other students within and outside CMC. The second edition of this manual was brought out in 1983 and had to be reprinted in 1987.

The Biostatistics Department currently offers several courses in biostatistics. These vary in duration and content, depending on the needs of trainees in the undergraduate and postgraduate programmes within the Institution. It also takes part in selected training programmes in sister organisations and in some national institutes.

The first classes on Biostatistics were offered to the first clinical year medical students in 1956, even prior to the establishment of the Department. These classes were aimed to inculcate biostatistical thinking and to develop a critical attitude among medical students towards statistics as well as to remove fear of numbers that generally prevails among medical fraternity. Apart from showing how various descriptive statistics are calculated, these courses concentrated on concepts of sampling variation, probability and inference based on samples drawn from a hospital population.

In 1958, the reorganized, integrated MBBS course included elementary statistics as one of the required subjects in the first year. To explain concepts and uses of biostatistics to medical students, even before they get exposed to subjects such as anatomy and physiology, was indeed a difficult task. A total of 36 hours were available, of which approximately 1/3 was for theory and rest for practicals. Using common health problems, the course emphasised statistical thinking and concepts more than statistical arithmetic. No doubt, the students were taught how to compute the various descriptive statistics and the use of various tests of significance. In order to apply the statistical skills the students were given field experience in a nearby community, wherein they carried out sample surveys and analysis of the data collected. These field exercises served as the precursor for the present COP (Community Orientation Programme).

In 1980, MBBS course was reverted back to $4\frac{1}{2}$ year programme, but CMC continued to provide instruction to the students in biostatistics in three blocks of time, initially during the first year prior to the COP postings, the second during the first clinical year (preliminary postings) and the third in the pre-final year. During the first year, most of the descriptive statistics and some aspects of statistical inferences are taught. Sampling and sampling problems are discussed. The students use previous COP survey forms, to apply their statistical knowledge and develop skills in the data analysis and interpretation. During the second series of lectures, the students are exposed to statistical aspects in design of studies based on clinical data and the use of hospital statistics. Selected articles from popular medical journals are used to expose various statistical concepts and verify some of the conclusions drawn. During the third series of classes, the emphasis is on vital and health statistics, demography and evaluation of family welfare programmes.

Apart from the undergraduate course in Biostatistics for medical students, a series of lectures were given to faculty and post graduates once in two years which also became quite popular. Tutorials were planned for selected post graduate medical students on specialized topics such as Biossay, Multivariate Analysis, Psychometry, etc. and a guidance was offered on research methods to medical and nursing post graduate students each year.

In 1969 the Master's Degree in Nursing was started at CMC, wherein Biostatistics and Research Methods were taught during the first year, at the end of which, there is an University examination in Biostatistics and Research Methods. Apart from this course to the M.Sc. (Nursing) students, short courses in vital and health statistics and in public health statistics are offered to Community Health Nursing trainees. From 1980 onwards, a short course in Biostatistics and Research Methods is offered to the B.Sc. (Nursing) students as well as to post basic B.Sc. (Nursing) students.

Appropriately organised courses in Biostatistics were offered to various para-medical students also. The earliest course was that given to the Medical Record Officer trainees from 1957 onwards. Later on, courses were offered to trainees of Diploma in Hospital Administration, Dietetics, Physiotherapy and Occupational therapy programmes. At present the Medical Record, Physiotherapy and Occupational therapy courses have become University programmes in which Biostatistics and Research Methods are routinely offered. In addition to students in regular programmes of Christian Medical College and Hospital the Departement organised courses for various research workers and supervisors. A short

course is given annually for medical officers and supervisors in leprosy control programmes. The Department is also involved in some extramural training such as the Medical Officers' course in National Institute of Nutrition from 1968 and more recently to students of an International Health Management course at Institute of Health Management at Pachod, Aurangabad.

The Department of Biostatistics has been closely associated in the development of a Managerial Diploma Course in Community Health Management at RUHSA and its curriculum. The students of this course learn the techniques of studying community health which includes Biostatistics, Demography, Vital and Health Statistics, Program Evaluation, Surveillance and monitoring of the Health Projects, and Research Methods. The students are also guided in the research studies undertaken by them.

During 1984-85, the Biostatistics Department became a founding member of the Epidemiology Resource Centre, with funds from Ford Foundation. Each year, one training course for clinicians and one course for health professionals are offered in Epidemiological Methods. These courses are of 2 weeks' duration. The Biostatistics Department takes an active role in organising these courses and also makes a major contribution to these courses.

Apart from Biostatistics Courses, the department also offers tutorials in Population Genetics (e.g. to M.D.(Community Health) and M.Sc. (Nursing Students), Operations Research, Systems Analysis and Work-study Techniques, Epidemiological Methods and Techniques of Programme Evaluation to various trainees within and outside the institution. Special *ad hoc* programmes for training of various duration are also offered in Biostatistics, Demography, Data processing and use of micro computers and Reserach Methodology. Recently the WHO had requested the Department to organise a 4 week training on use of micro computers in Health Care and Planning to four trainees from Vietnam.

Health and Medical Services invariably require production of masses of data, whether routine or project oriented. Expertise is also needed as teachers and researchers in Biostatistics for teaching and guiding health personnel for proper utilization, interpretation and use of statistics in health and medicine. With a view to provide professionally trained personnel for the above stated objectives, the department initiated 2 courses: (1) diploma in health statistics in 1980 to prepare statistical assistants and technicians, giving them a broad-based training in Biostatistics and related disciplines as well as a short exposure to computer programming and use of micro computers: and (2) in 1986, the M.Sc. (Biostatistics) course was started under Madras University, probably the only University course in Biostatistics in India. The department is also recognised for Ph.D. in Biostatistics since 1977.

The aim of Christian Medical College and Hospital is the establishment, maintenance, and development of CMC, where men and women may receive an education of the highest grade in the art and science of medicine and of nursing, to equip them in particular in obedience of the Christ to provide for the full recognition of the moral and spiritual basis of life in relation to health. We believe that the Biostatistics Department contributes to this goal. ❑

THE PRESENT STAFF - 1990

Professor and Head of the Department :
Dr.P.S.S.Sundar Rao, M.A., M.P.H., Dr.P.H., F.S.S., F.S.M.S.

Associate Professor
Dr.J.Richard, M.A., Ph.D.

Lecturers
Mr.K.G. Selvaraj, M.Sc.
Dr.L.Jeyaseelan, M.Sc., Ph.D.

Senior Demonstrator
Mr.S.Muthurathnam, M.Sc.

Statisticians
Mr.B.Antonisamy, M.Sc.
Mr.Lalith Kumar Samuel, M.Sc.
Mr.J.Arockiasamy, M.Sc.
Mr.P.Marimuthu, M.Sc.
Mr.A.Amalraj, M.Sc.
Mr.V.Swaminathan, M.Sc.
Mr.V.P.Natarajan, M.Sc.
Mr.A.Sakthivelusamy, M.Sc.

Statistical Assistants
Mr.K.Mani, M.Sc., D.H.S.
Mr.Jebaraj Daniel, B.Sc.
Ms.Adeline Royal, B.Sc., D.H.S.
Mr.V.Muralikrishnan, B.Sc.
Mr.D.Raj Kennedy, B.Sc.
Mr.M.Baskar Inbaraj, B.Sc.

Anthropologists
Dr.M.Lakshmanudu, M.Sc., Ph.D.
Dr.K.N.Subramaniam, M.Sc., Ph.D.
Dr.A.Chandrasekar, M.Sc., Ph.D.
Ms.D.Aruna, M.Sc.
Ms.M.Padmavathy, M.Sc.

Psychologists
Ms.A.Kanikkaimary, M.A.
Mr.E.Joseph Alexander, M.A., M.Phil.
Ms.Mercy Arunmozhi, M.A., M.Phil.
Mr.G.Devaraj, M.A., M.Phil.
Ms.K.Mumtaj, M.A.
Mrs.Vasanthal, M.A.
Ms.G.Tamilselvi, M.A.
Ms.S.Nalini, M.A.

Programmer
Mr.David Selvapandian, B.Sc.

Data Processing
Mr.M.Irudayaraj
Mr.Julius Leonard Samuel
Ms.Padma Vasanthakumari
Mrs.G.Kessiah Rupavathy, B.A.
Mr.L.Maran

Artist
Mr.R.Samuel Sargunar

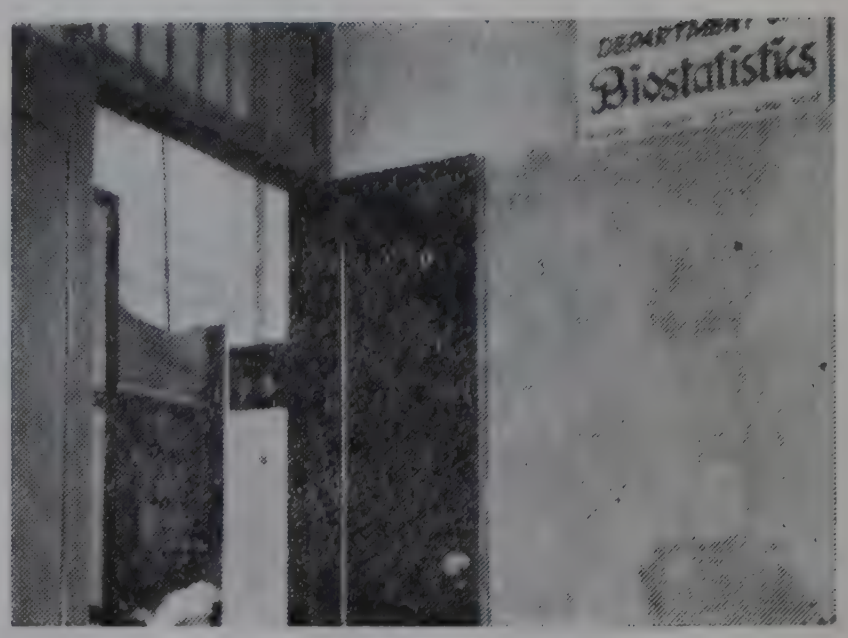
Secretarial and General Staff
Mr.V.Krishnan
Mr.K.Sekar, B.A.
Mr.D.Balaji, B.Sc.
Mr.L.Jeyaseela Selvanathan
Mr.M.Jayaraj
Mr.R.Selvakumar

Radiographer
Mr.John Samuel

Field Investigators
Mrs.Mary Amalraj
Mrs.Beulah Asirvatham
Mr.S.Arivazhagan
Mrs.K.Bhuvaneswari
Mrs.Mary David
Mrs.Hazel Durai
Mr.T.Kumaraguru
Ms.R.Lilly Rani
Ms.G.Latha
Mr.V.Mohanakrishnan
Mrs.D.Neela
Mrs.Mable Prakasam
Mr.M.Rajendran
Mrs.N.S.Shanthi
Mrs.G.P.Shanthakumari
Mrs.G.Thilagavathy
Ms.Vasantha
Mr.C.Venkatesan
Ms.G.Vijayakumari
Mrs.Jessie Vincent

Department of Biostatistics

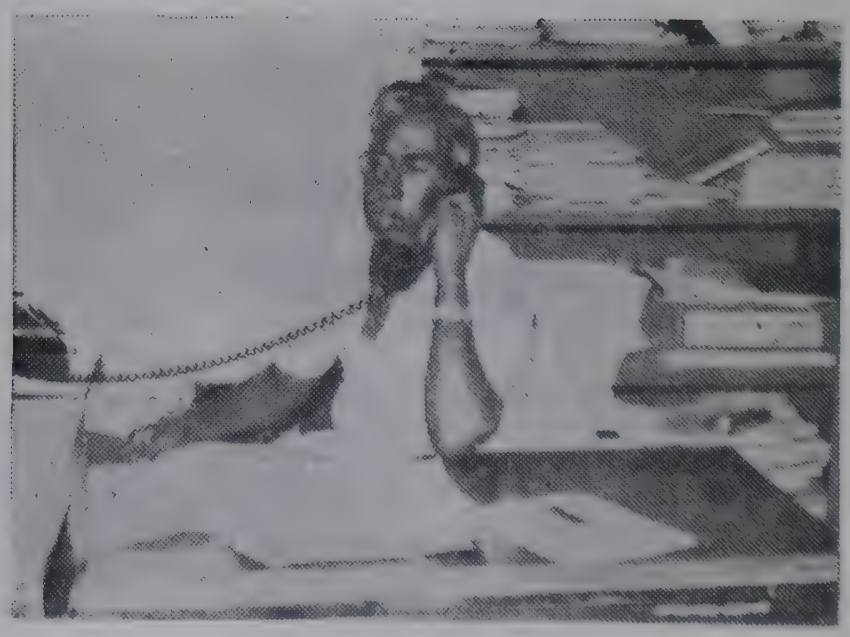
View from outside



View from entrance

Library

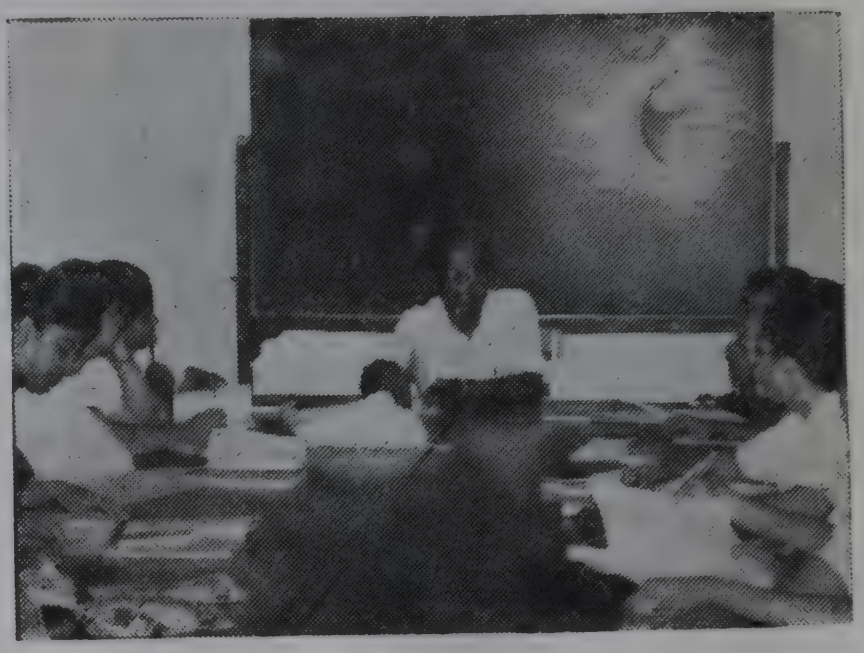
Weekly Review Meeting



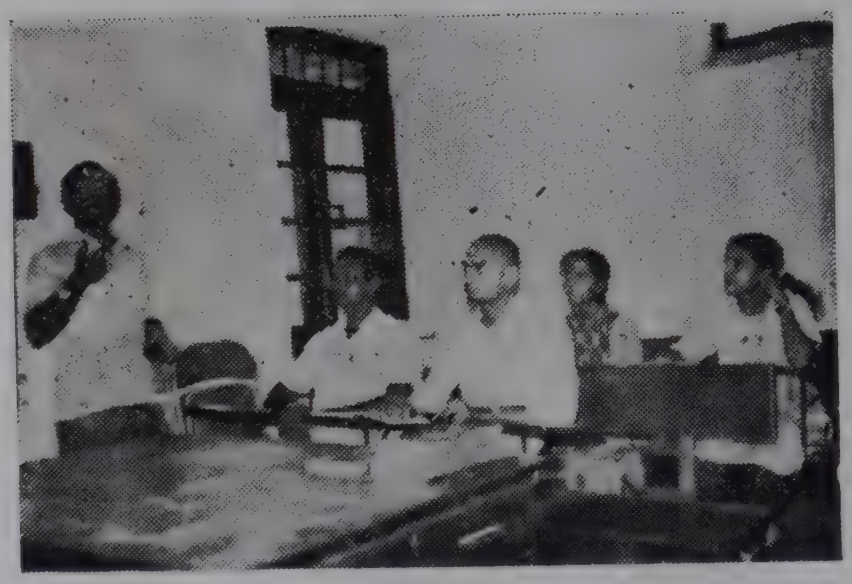
Secretarial Section

Teaching Programmes in Biostatistics

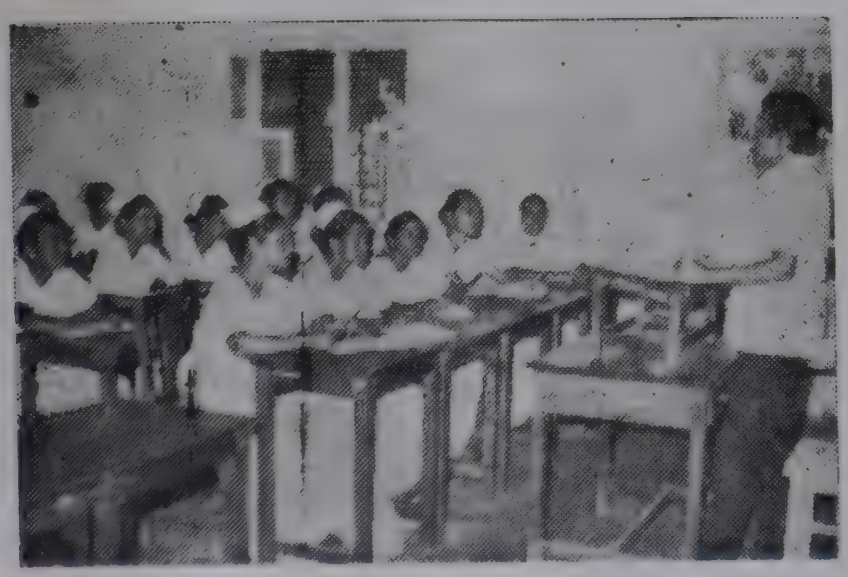
M.B.,B.S.,



M.Sc. (Nursing)



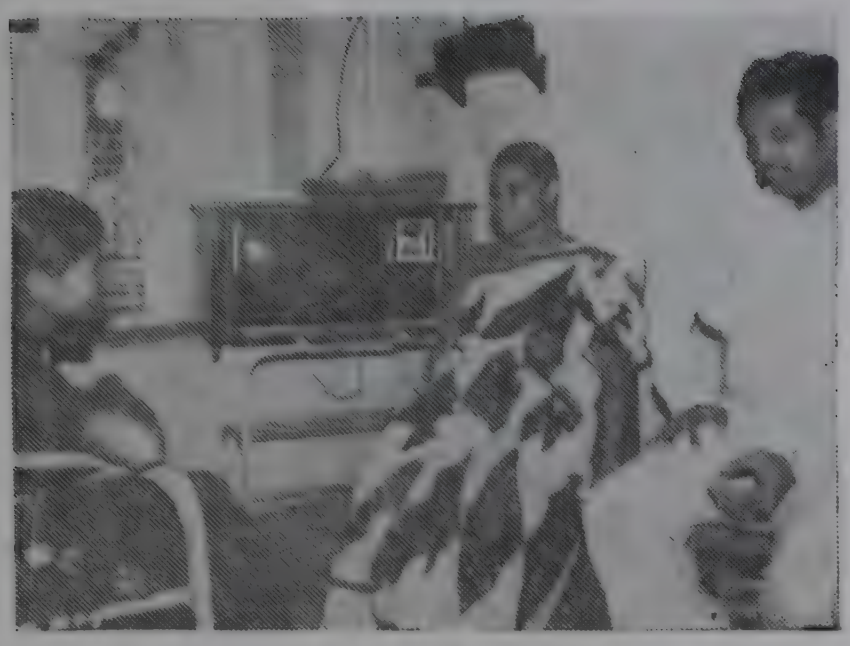
M.Sc. (Biostatistics)



P.C. B.Sc. (Nursing)

Diploma in Hospital Administration

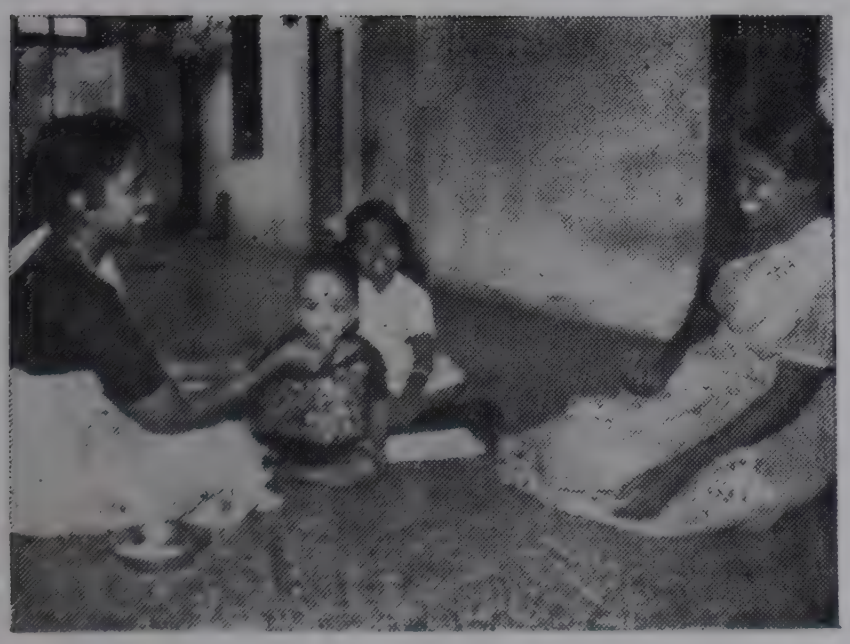
Research Activities



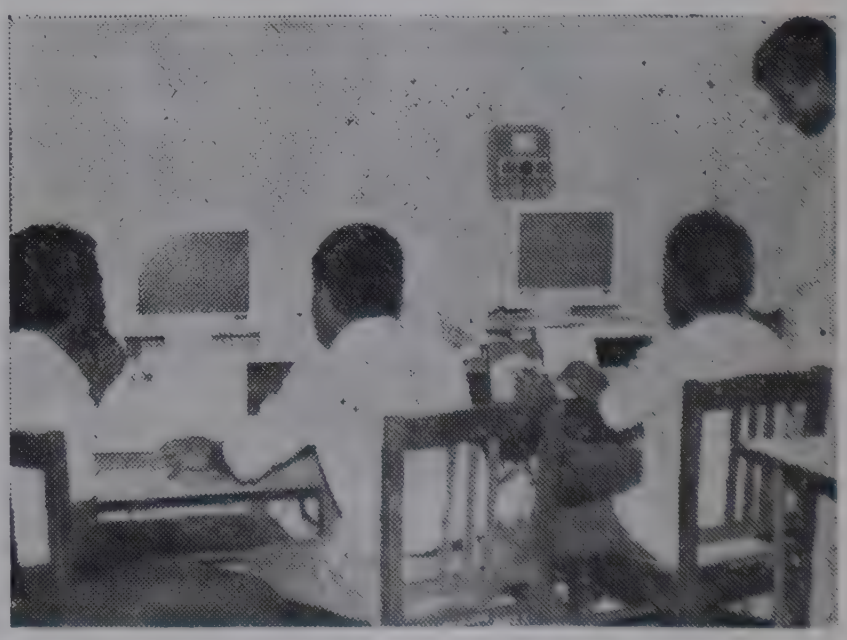
Follow-up of pregnant women for a longitudinal study

Preparation for field visit for a study on adolescent growth

Planning for publication of a research monograph



Data Collection for a study on protein energy malnutrition



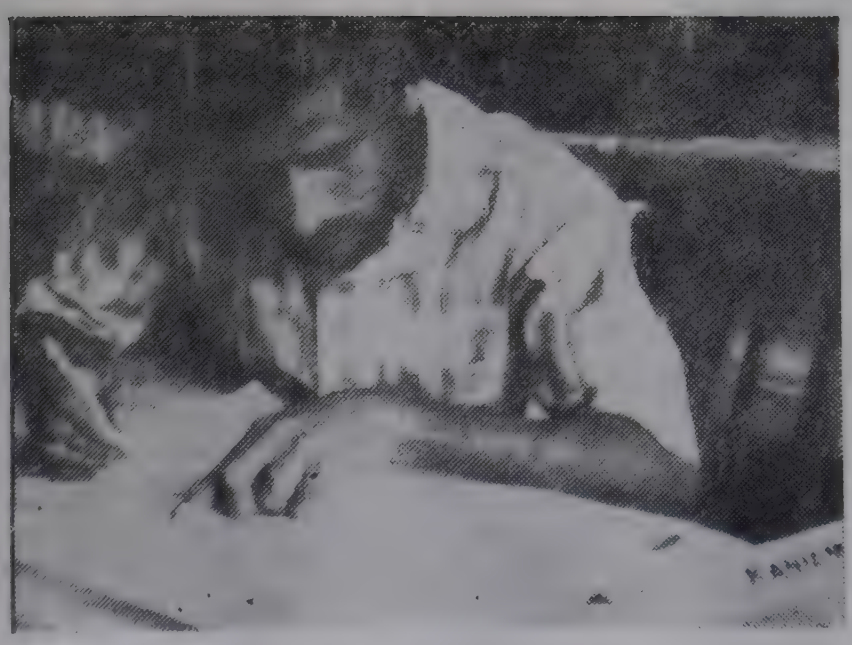
Data processing at Computer Centre

Service

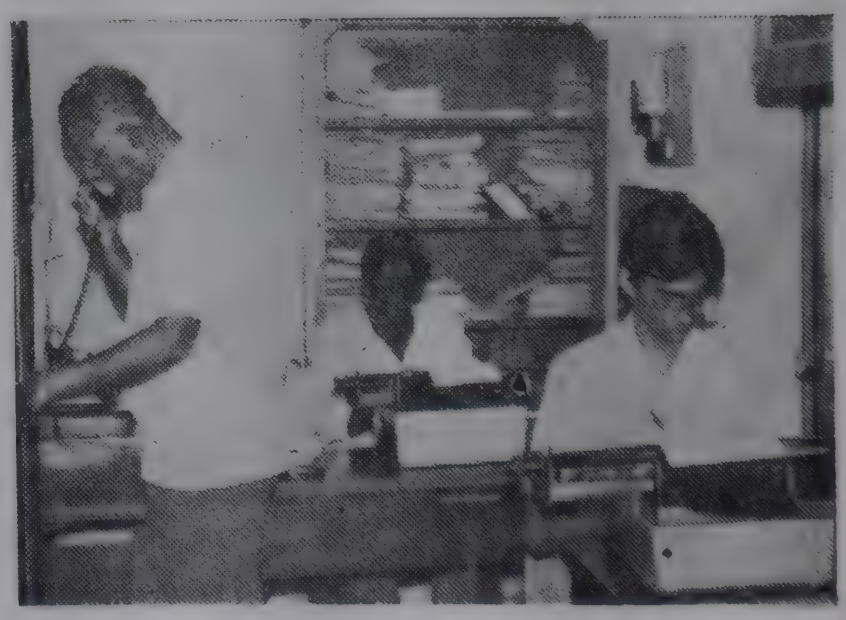
Data analysis at Community
Orientation Programme

Planning for lectures for
ERC Worksnop

Discussion for organisation of a
Scientific Seminar



Preparation of maps for
Community Health Survey



Preparation of
Research Bulletin

VELLORE: A HISTORICAL OUTLINE

Vellore is a historic place with a hoary tradition, situated almost on the banks of the river Palar. Today it is the headquarters and most important town of North Arcot district. Although the town is not spread out over a wide area, it is one among the six largest towns of Tamilnadu. It is also an important commerical centre connecting Tamilnadu and Andhra Pradesh.

It is interesting to note that Vellore or Raya Vellore as it is also known, had developed into one as early as the 7th centruy A. D. under the Pallavas. Many believe that the fort exhibits signs of having been laid out by Italian engineers, but according to the local tradition it was built by Bommi Reddi, a native of Bhadrachalam on the banks of the Krishna. He and his brother Thimmi Reddi were the sons of Yadama Reddi. As their half-brothers were plotting to murder them, to take away their property, they fled from their native town. On their journey to Rameswaram and other holy places, they decided to make their living by cattle breeding. They were very successful and soon became wealthy. This led a petty chief to attack them. But the brothers defeated him, which pleased the Raja that he gave Bommi Reddi, many presents and privileges. In the year 1274, he started work for the construction of the present fort and the temple.

From 1295 until 1557 twelve Raja Kings ruled over Vellore in succession. The last Raja had an illegitimate son by a servant girl who lit the palace lamps. Although he was very fond of this son, Krishnadeva Rayalu, he was persuaded to have him put out of the way. He entrusted this unpleasant task to a cobbler and a dhobi, but these servants did not take the life of this son and in A.D. 1586 Krishnadeva Rayalu ascended to the throne.

About the middle of the 17th century, the Sultan of Bijapur, Khan seized Vellore and so began a period of Mohammedan rule. Abdulla Khan, the son of his successor desecrated the temple by murdering a dancing girl there and so services ceased and the idol's jewels were hidden. There are still rumours concerning the place of these hidden jewels.

During the rule of Abdulla Khan, in A. D. 1675 the Maharastras under Tukoji Rao besieged the fort for fourteen months. It is said that Tukoji Rao noticed blood coming out of a stone in a village not far from Vellore. Through a dream he learned that the stone was the God Chelvavinayaga, so he built a temple in that village to the Swami. The Swami told him to perform a sarpayagam on the banks of the Palar with the result that a plaque of cobras infested the fort. When this happened Abdulla Khan gave up possession of Vellore. Worship was re-introduced into the temple and continued until the Mohammedans again besieged the fort during the rule of Tukoji Rao's son a turbulent period during when the fort was ruled by Mohammedans and Maharastras in turn. When Mustaza Ali was the ruler, he was helped by Dupleix, the French Commander to rebel against the Nawab of Arcot whose vassal Vellore was and the English Allies. The Nawab and the English proved stronger, however and he surrendered in 1765 and the fort was afterwards used as an English garrison. Vellore was again besieged in 1760 by Hyder Ali, but the fort held out for two years against overwhelming numbers and difficulties until an army from Madras came with reinforcements and Hyder fell in battle.

After the fall of Srirangapatnam in 1799, Tippu's 12 sons and daughters and their servants were imprisoned in the fort among several hundred persons. Mutiny was instigated by members of Tippu Sultan's family when a new regulation was issued by the English Commander-in-chief of the Indian troops. Hindus were forbidden to wear ear-rings or caste-marks and Mohammedans were made to shave their heads and trim their beards in a certain manner, introduction of leather head dress with a turn screw in the shape of cross. The British troops were taken by surprise and many were massacred. Fateh Haider, the second son of Tippu Sultan, was proclaimed the Raja, and the Mysore flag hoisted. An English officer at Arcot put down the mutiny after killing about 350 sepoys. The Mysore princess were sent to Calcutta, but the four mahals, ten tombs of these women and about 400 tombs of persons con-

01821
COMMUNITY HEALTH CELL
326, V Main, I Block
Koramangala
Bangalore-560034
India
MP-100

nected with the family are on the north side of the Arcot road next to the Crown Talkies.

According to source close to us the last king housed at the Vellore Fort was Sri Vikrama Raja Singha, Ex-Royal King from Kandy, Ceylon. He was treated as an Ex-Royal King with all amenities of life by the then British Government. He lived in this Fort comfortably from 1815 - 1821. He was gifted with some land at Vellore town and the burial ghat wherein his mortal remains were interred also belong to the descendents of the late King. Some direct relative is stated to be the holder of that piece of land allotted to the King and his successors. It is happy to recrod that his great grandson Mr. Santhana Raja is leading a retired life comfortably at Coimbatore.

The temple stands near the northeast corner of the fort. Its entrance is topped by a fine gopuram with massive gates and rich carvings. Among the figures one represents Bommi Reddy and his wife. The next outstanding sculpture is found in the Kalyana Mandapam, or hall in which the Idol was placed during the yearly celebration of his marriage. It contains monolithic sculpture of unusual beauty said to be some of the finest in India. The outer pillars represent intricately carved mounted figures. The centre of the hall is supported by huge monoliths cut into groups of five pillars, joined by thin stone panels fretted with graceful patterns. These are all carved from one stone, a marvel of workmanship.

The fortification of the fort consists of a main rampart broken at regular intervals by round towers and rectangular projections. The main walls are built of massive granite stones which have been so remarkably cut that they fit together without the necessity of mortar. The upper parapets are brick work which give rise to the theory that European architects are responsible for that part of the construction. With its moat formerly occupied by large alligators the fort was considered practically impregnable. On the north west corner of the rampart there is circular stand from where you can get an aerial view of Vellore Town.

Vellore owes its present glory and fame to the Christian Medical College Hospital which stands in the heart of the town. If today Vellore is a name known throughout the world it is undoubtedly because of this great institution. Begun in a small hut by Dr. Ida Sophia Scudder, a dedicated medical missionary from the United States, the institution is now an international centre of education, hospital care, research, rehabilitation and rural service.

Vellore town extends over an area of about 11 sq. miles and has a population of about 2.47 lakhs. It is 700 feet above the sea level and is surrounded by hills. The Palar river being the chief source of water supply, the town gets clean, uncontaminated water throughout the year. The climate of Vellore is generally hot and is hotter in summer. The people of Vellore are very hospitable and accommodative. This accounts for the presence of a large number of Malayalam, Telugu and Hindi speaking people in the town. Now the town Vellore stands as a cosmopolitan nature.

A visit to Vellore the abode of C.M.C. Hospital with a variety of other attractions, will undoubtedly be a delightful experience. ❑

- Taken from "Vellore Guide"

EVOLUTION OF A DISTRICT HEALTH INFORMATION SYSTEM

Introduction

It is well known that in India, upto one third of all childhood deaths are preceded by vaccine preventable diseases and immunization is a very effective way of reducing childhood mortality.

The effectiveness of an immunization programme is shown by its impact in reducing the incidence of targetted diseases.

In India today, the systems that report vaccination coverage for EPI vaccines are well developed. With the development and extensive use of the 30-cluster sample survey technique, it is now possible to quickly validate reported vaccine coverage. However, systems to document the incidence of EPI-diseases are poorly developed. We believed that linking up private hospitals and clinics into a network that reports cases with EPI diseases was possible and that this would augment the surveillance reports filed by Government Hospitals (GH) and Primary Health Centres (PHC) to a great extent. Such an augmented report could then be used for a health information system.

Given below is a report on the NADHI network, how it evolved and its performance.

Evolution of the reporting network

The EPI disease surveillance system in the North Acrot District before networking private agencies consisted of disease reports that were sent to the District Health Officers from 44 PHCs, 17 Taluk level Government Hospitals, one District level Government Hospital and 19 Government Dispensaries.

In order to expand the reporting system to include the private agencies, field workers from the ICMR Centre of Virology visited each town and compiled a list of private hospitals and clinics in the district. Medical shops (Pharmacies) and secretaries of medical associations were valuable resource persons for compiling such a list. Medical representatives visiting the Christian Medical College Hospital were another source from whom lists were compiled. Letters were written to individual physicians in the list asking them to report EPI-diseases coming to them for treatment. A representative from the project office visited each sentinel centre (hospital and clinic) and explained how the system worked. A simple proforma was designed and printed on the back of pre-paid post cards and the physicians were asked to fill one card per patient. A register was given to each centre and a copy of the contents of the postcard was asked to be maintained on this register.

Government Hospitals and dispensaries were visited and registers were introduced. In these registers, EPI-disease reports could be entered and kept as a permanent record. The reports from these registers were collected once a month after a site visit by project personnel.

Employees State Insurance (ESI) Hospitals, ESI dispensaries and Railway Hospitals in the district were also visited and urged to send disease reports using postcards.

Thus, disease reports reach the ICMR Centre in three different ways. 1. Monthly reports from Primary Health Centres through the District Health Officers. 2. Post cards with disease reports that come in the mail. 3. Data extracted from Government Hospital registers once every month.

The data are entered into a computer as and when they reach the department and once a month they are processed and duplicate entries deleted. The processed data are published in a newsletter called North Arcot District Health Information (NADHI) every month.

When this network started, reports on all EPI diseases except tuberculosis were obtained. Subsequently four other diseases namely rabies, jaundice/hepatitis, encephalities, and meningitis were added to this list.

Reprinted with permission from "North Arcot District Health Information" (NADHI), Vol.6, No.9, Sept. 1989.

Results

Figure 1 shows the rate at which the sentinel centres were recruited into the system. Between July and November 1986, January and February 1987, a sharp increase in the number of recruited centres can be seen. This increase is because of recruitment drives launched by the ICMR Centre. Currently there are over 450 centres which belong to the net work.

FIGURE 1

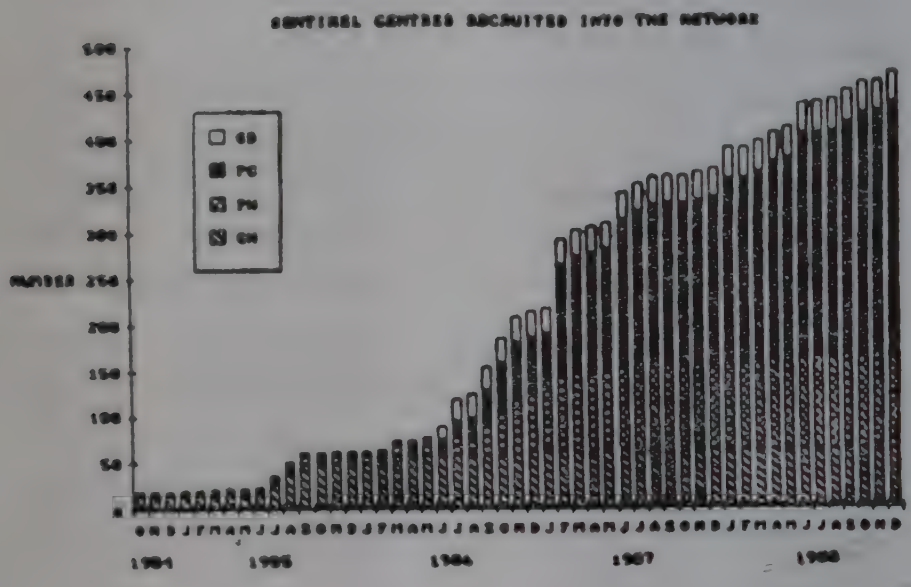


FIGURE 2

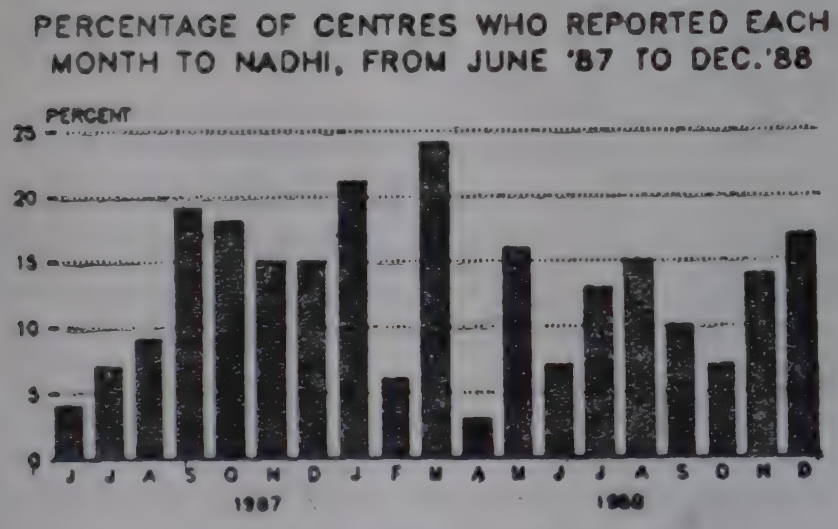


Figure 2 shows the proportions of centres that reported at least one case each month for the period June 1987 to December 1988. Less than 25% of the centres reported in any given month.

Figure 3 shows a comparison between the numbers of cases sent by the Government agencies versus that sent by the private agencies. More than 60% of polio cases, 25% of measles cases, all the diphtheria cases, more than 30% of tetanus and 70% of whooping cough cases were reported by private agencies. The Government agencies reported more measles and more tetanus cases than private agencies.

FIGURE 3

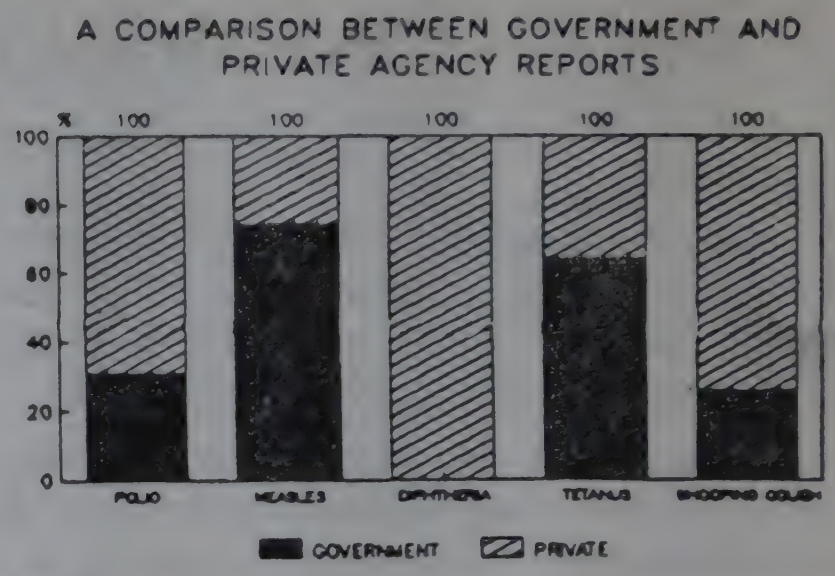


Table 1

Cost of starting and running the sentinel surveillance system

Recurrent cost/annum	Rupees	% of total cost
Personnel	56400	38.8
Per diem	1000	0.7
Transport/maintenance	0	0
Travel	500	0.3
Supplies (Office, post cards, Newsletter)	42000	28.9
Sub total	99900	68.7
Capital Cost (not annualised)		
Computer	8000	5.5
Building	37440	25.8
Sub total	45440	31.3
Grand Total	145340	

Table 1 shows the recurrent and capital cost involved in running this system. Personnel cost and supplies, including printing and postage of NADHI newsletter are the two large items of recurring expenses. Among the capital items, office space used for running this system formed a large part of the capital cost. Recurring expenses alone without the capital items was less then 9,000 rupees per month.

Discussion

Private Hospitals and Clinics are found in all urban areas in India. Persons who develop illnesses in rural areas are often taken to urban areas for medical treatment. Because of this, these hospitals and clinics have a wide catchment area which is rural

as well as urban. A collection of these reports hence provides an insight into the magnitude of the problem of many diseases in both rural and urban areas. In our network we utilized these existing private agencies to augment disease reports from the Government agencies and we found that a large proportion of cases do not come to the attention of government agencies. Hence, private agency reports are an important and valuable resource.

Most of the cases of measles reported through this network were reported by Primary Health Centres. We believe that the multipurpose health workers identify EPI diseases only if it occurs in epidemics. From their reports we have often found that measles cases reported by the Primary Health Centres are epidemics in specific villages.

While it is good to improve the reporting of diseases by multipurpose health workers in the Primary Health Centres, a cheap and quick way of adding to the worker's report is by networking private agencies within a distrcit. Our network costs less than rupees 9,000 as running expenses for the 50 lakh population or 18 pasie per head per month. It does not require the use of expensive capital items like motor vehicles since the public transportation system is adequate for data collection and maintaining contact with the reporting centres. We use our existing office space for this project and have apportioned a part of the cost of this office building for costing purposes. A computer is useful for running the system, although when the system first started all the data was entered on registers and hand processed. Only 8000 rupees is shown against computer in the capital cost. This has been based on the computer time that is used by us for running the Health Information System. If a computer has to be purchased primarily for this purpose, this would increase the capital cost by almost 50,000 rupees.

Although over 450 centres have been recruited into the reporting system, only a proportion of them send reports every month. We have often questioned the non-reporting centres in order to determine if the centres have forgotten to report. However we are told by these centres they do not see cases with EPI diseases. From Figures 2 and 3 we can see that even the small proportion of centres who report add a considerable number of cases to the existing Government system.

We believe that all the districts in India should strive to link the private agencies along with Government agencies in a reporting system like the one in North Arcot District. Although 'the best available data may be bad', time trends from this data, besides helping to monitor the health programmes will teach us a great deal about the epidemiology of some of the reported diseases. ❑

STATISTICS IN NUTRITION

K.Visweswara Rao
M.A., M.S.Hyg., Ph.D., F.I.S.
National Institute of Nutrition
Indian Council of Medical Research
Jamai Osmania P.O., Hyderabad - 500 007 INDIA

In most areas of the world, malnutrition is one of the major public health problems. In some countries, energetic attempts to improve the situation are already under way. Progressive improvements in health and nutritional status are observed in many developing countries. For the assessment and evaluation of the nutrition and health status of various segments of the population, good and progressive availability of statistics will be an appropriate asset for the administrator, public health worker and policy maker. These statistics will serve as a key for research in discovering facts and for the development of guidelines to improve the nutrition and health.[1,3,4,7-10] The statistics of nutrition, available in India and of interest for future are briefly discussed and presented below.

Sources and availability

Statistics of nutrition available in India can broadly be classified under four categories: statistics available through (a) nutrition and anthropometric surveys; (b) food balance sheets; (c) food consumption or dietary surveys and (d) ameliorative and public health measures undertaken. Because of close association of morbidity, mortality and nutritional status, the statistics of demography, health, food and agriculture are often utilised for the interpretation of nutrition problems.

The results of diet and nutrition surveys conducted by the nutrition and health departments of the State Government have been compiled and published as reports by the Indian Council of Medical Research and the Directorate General of Health Services. The reports contian brief results of diet and nutrition surveys, laboratory and field investigations, information on ameliorative measures in progress, nutrition education and publicity in each state. The statistics contained in these reports indicate needs for better coverage of areas, statistical representation and presentation of results.

Food balance sheets generated by the Ministry of Food and Agriculture, Government of India and Food and Agricultural Organisation of the United Nations are available up-to-date. Nutritive values of food available at the national level are also published. Improvements in the accuracy of the statistics related to the food available for consumption are attempted. Statistics on production, usage and wastage of meat, fish, vegetables and condiments are found in need for improvement. Feasibility of food balance sheets for staple food items have been utilised for use at a community and state level also.[5,10,11]

Statistics of food consumption are available through some reports of the National Sample Survey Organisation (NSSO) at the National and State level. The data on food consumption were obtained by oral questionnaire method for thirty days. Schedules utilised were comprehensive on all aspects of food consumption[10,11]. The NSSO data will be of use for interpretation of consumer preferences to foods and the proportion of total food expenses spent on food consumption. There have been some All India Consumer Expenditure Surveys conducted by the National Council of Applied Economic Research which have similar limitations[10,11] as those of NSSO.

Statistics on dietary intake, prevalence of nutrition deficiency signs and growth status measured in terms of measurements of height, weight, arm circumference etc., have been available through research investigations carried out by the National Institute of Nutrition, Hyderabad, the All India Institute of Medical Sciences, New Delhi, the All India Institute of Hygiene and Public Health, Calcutta, the Christian Medical College, Vellore, Sri Avinashilingam Home Science College, Coimbatore and other organisations with the assistance from the ICMR and international organisations. The nutritional studies undertaken by these research organ-

isations meant to evaluate the nutrition and health of the population in relation to their diets and modes of life. The studies covered either the whole population in a given area or a carefully defined segment identified by sex, age, race, location of dwelling, occupation, socioeconomic status, environment and other characteristics. The information generated includes quantity and quality of food actually consumed, estimates of calorie and nutrient requirements, evaluation of physical and mental efficiency and manifestations of good or ill health. The other useful data include: methods of food processing and food preparation, social and economic problems, incidence of diseases of various kinds, life expectancy and death rates from various causes. Findings can be utilised to improve health by: educating to correct faulty eating habits and to improve methods of food processing and preparation, supplementing food or diets with nutrients found to be low in the available food supply; giving economic, social or medical aid where needed; and evaluating effectiveness of measures taken to correct causes of malnutrition. Since these studies are carried out on specific populations at some specific periods, the findings and observations have limited application and generalisation at the national/regional level.

There have been no organised studies to determine the effects of changing society on the nutritional status of the people and their dietary intakes. There have been several nutrition programmes in operation and it is expected that these programmes will bring about changes in the pattern of life. The impact of these programmes on the nutritional status of the community, has, is worth for evaluation and for incorporation of the needed improvements in the programmes. Because of these considerations and to have generation of statistics of nutrition, National Nutrition Monitoring Bureau[1,6,10,11] (NNMB) was set up by the ICMR at the National Institute of Nutrition, Hyderabad in 1972. The plan of work of NNMB consists of monitoring the diet and nutrition situation among various population groups in the selected States. Clinical nutrition, anthropometric, diet and socioeconomic surveys are conducted. The Indian States covered through NNMB are Andhra Pradesh, Tamil Nadu, Kerala, Karnataka, Maharashtra, Madhya Pradesh, Gujarat, Uttar Pradesh, West Bengal and Orissa. Inspite of the initiation, still all India regional coverage and national estimates of nutritional status could not be possessed so far[1,4,6,9-11]. Also, the data generated with improved data base, sampling design and analysis will serve and improve its focus for a good and fertile utilisation in the field of research and planning[1,6,9,11].

Hospitals and primary health centres are also the good sources for generation of nutrition statistics[9,10]. Small scale hospital studies indicated that there are good interactions between nutritional status and the types of morbidity or ill-health suffered by communities[10,11]. It is of interest to improve and document the nutrition related disorders in the hospital admitted patient case sheets and attendances at outpatient departments of hospitals and health centres. They will be useful for research on factors related to disease and quick recovery. Work on the development, research and training programmes generated in the maintenance and use of hospital statistics at centres like Christian Medical College, Vellore, are praise-worthy.

Indicators and needs

It is good to have a package of indicators selected from: (a) vital statistics or Demographic indicators; (b) housing and environmental indicators; (c) anthropometric and clinical nutrition indicators; (d) socioeconomic indicators and (e) morbidity and nutrition indicators (through hospital statistics of admitted patients). Many combinations of indicators are possible from these categories and suggested for use. The results of analysis of data showed that all these are, in fact, well correlated[12,13]. Housing conditions, environmental sanitation, availability and prices of staple food items are good indicators of nutritional status as is the age specific morbidity and mortality rates, particularly in the 0-1 and 1-5 year age groups and the women of child bearing age. It will be good to establish more precisely the value of each of these categories of indicators in the prediction and assessment of the nutritional status[8,12,13].

Methodological improvements

Statistical guidance is important in every phase of survey work and research work in the development of nutrition or health indicators[3,4,9].

If statistically sound sampling procedures based on probability are not followed, the significance of survey results will at best be uncertain and possibly biased and incorrect. With correct sampling, investigation can provide accurate information on an examination of only a portion of the population with saving of time, money and staff. Very few of the investigations conducted are observed to adopt[2,7,10,11] random sampling procedures in the selection of the subjects or households. Purposive sampling or selection at convenience are adopted.

Some understanding by the nutritionist of statistical principles is valuable in order to bridge the gap between the two technical fields of knowledge.

The size of the sample for each individual survey can be determined by the size of the population group, time available for study, the probable prevalence of the characteristic sign or syndrome to be measured and the degree of precision required in the results. Literature on this aspect has been flowing for good use[2,7].

Attention and research work are of interest to be given to the practical and non-statistical errors (inter observer, intra observer and experimental variations etc.) inherent in the measurement and studies.

In practice, in the selection of the sample size, a balance will have to be struck between statistical requirements and local field realities, such as difficulties of travel in certain terrain or the absence of local census.

The combinations of methods and approaches usually adopted in nutrition surveys will call for different sample sizes and possibly, different sampling techniques using the multiphase method.

Scales of calorie coefficients or consumption units are often used to determine the food and nutrient intakes of individuals in a family from the data based on family diet surveys. These scales indicate how the total family food should be divided among the members of a family based upon physiological needs (dietary allowances). It is however observed that there are considerable differences between the calorie or consumption units and the food which is actually distributed within a family (or a community) to its several members[14,15]. The method of expressing individual intake of nutrients as per capita in comparison with requirement was suggested as useful and good.[14,15]. Methodological research on conduct and reference periods of dietary survey methods is useful to provide valuable contributions.

Analysis of data-statistical procedures

In a study of single variables, either means (for interval data) or medians (ordinal or interval data) are used. It is important to examine distributions because they are often not normal. Knowledge of the shape is needed for deciding on appropriate conversions before running a multivariate analysis or tests of inference. Various tests of inference are of immense use and necessary in the analysis of data.

Extensive use of cross-tabulations of average quantities of foods consumed per caput by sub-groups of households, based first one to one, then another independent variable can be attempted. Such bivariate tabulations are useful to trace combinations of foods consumed by high, medium and low consumers of staple food. It is also helpful to compare distributions for alternative measures for similar concept such as indicators of nutritional status. Ordinal scales may be developed from interval measures of the food consumption and used in cross-tabulations to sort out households with children in the high, medium or low nutritional status category[12] based on a measure of height, weight or weight for height% (or weight/height^2).

Better analysis and interpretation of data can be attempted in measuring food consumption, nutrient intakes and nutritional status. Distributions within sub-groups of population and multivariate analyses are possible as they can assist in obtaining(1) a picture of differences in severity of the problems and in factors contributing to such differences, and (2) projections of the impact of inputs and activities on consumption and nutrition of particular groups.

Analysis of variance with multiple comparison tests or conventional normal curve tests and small sample parametric and nonparametric tests of inference suitably can be chosen and appropriate logical inference can be drawn.

Analysis of the relationships between indicators of nutritional status (dependent variables) and

indicators of factors contributing to variations in nutritional status (predictor variables) in the form of cross-tabulations can identify different degrees of malnutrition among main population groups. The analyst can attempt to rank the factors in relative imporatance and estimate the potential impact on nutritional status with the use of multivariate analysis.

Identification and measuring of variations in nutritional status and food consumption among subgroups in the population and relationships with economic, social and cultural factors can be done well with the use of multivariate statistical and analytical procedures. The need for multivariate analysis is generally recognized, but use has been very limited. With the availability of computers, use of multivariate analysis in the field of nutrition and health can be improved. Topics of multivariate analysis - stepwise multiple regression analysis, stepwise discriminant function analysis, factor or principal component analysis, cluster analysis, path coefficient analysis and canonical correlations are of good utility for evaluation of the impact or relationship of factors. Studies show a convincing and interesting contribution with their utilisation[12,13].

Abstract

Needed improvements and current position of the availability and sources of statistics of nutrition in regard to coverage, content and timelines are presented and discussed.

REFERENCES

1. Gopalan, C.,1988. NNMB - Its importance to nutrition research and National planning. Nutrition Foundation of India Bulletin. Vo. 9. No. 2 pp 4-6.
2. Jayaseelan and Sundar Rao, P.S.S., 1989. Methods of determining sample sizes in clinical trials. Indian Pediatrics. Vol. 26, pp 115-121.
3. Ramachandran, K., 1990. Some thoughts on a Database in health in India. Proceedings of the 6th ISMS Convention and the National Seminar on Statistics in Medicine, Health and Nutrition, Hyderabad (in press).
4. Ramachandran, K., 1987. Food consumption in rural Indian households - Has it increased in recent years? Nutrition Foundation of India Bulletin. Vol.8 No.1 pp 1-3.
5. Muhammad Shafi, 1960. Land utilisation in Eastern Uttar Pradesh (food balance sheets). The Department of Geography, Muslim University, Aligarh. pp 231-264.
6. Srikantia, S.G., 1988. The National Nutrition Monitoring Bureau. Nutrition Foundation of India Bulletin. Vol. 9 No.2, pp 1-4.
7. Srivastava, RN., Verma, B.L. and Shukla, G.D., 1985. Principles and practice of statistics in Medicine. Himalaya Publishing House, Bombay.
8. Sukhatme, P.V., 1966. The 'World's food supplies'. Journal of the Royal Statistical Society.Vol. 129, No.2 pp 222-238.
9. Sundar Rao, P.S.S., 1990. Statistics of Health and Nutrition. Critical appraisal of availability and Needs in India. Proceedings of the 6th ISMS Convention and the National Seminar on Statistics in Medicine, Health and Nutrition. Oct. 27-29, 1988 (in press).
10. Visweswara Rao, K. and Srikantia, S.G., 1982. Nutrition statistics in India. From: Social statistics-Health and education (Database of Indian economy Vol.4) editors Ashish Bose and others. pp 72-92.
11. Visweswara Rao, K., 1977. Availability of statistics of nutrition and data requirements. Proceedings of the National Seminar on Social Statistics (Central Statistical Organisation, Govt. of India, Allied Publishers. New Delhi). Vol. II. pp 437-457.
12. Visweswara Rao, K. and Balakrishna, N., 1990. Discriminant function analysis - A case study of some socioeconomic constraints on child nutrition. Indian Journal of Medical Research. Vol.92, Series B. pp 66-71.
13. Visweswara Rao, K., 1977. Analysis of the relative importance of factors affecting body weight changes in preschool children by nutritional status. Proceedings of the 41st Session of the ISI. Bulletin of the International Statistical Institute. Vo.47, Book No.4, pp 717-721.

14. Visweswara Rao, K., Thimmayamma, B.V.S., Rau, P. and Swaminathan, M.C., 1980. Validity of calorie coefficients for the estimation of nutrient intake of preschool children. Indian Journal of Nutrition and Dietetics. Vol.17, pp 370-376.

15. Visweswara Rao, K., Thimmayamma, B.V.S., Rau, P. and Swaminathan, M.C., 1981. Validity of calorie coefficients for the estimation of nutrient intake of adults. Indian Journal of Nutrition and Dietetics. Vol.18, pp 56-61. ❑

MENTAL HEALTH STATISTICS IN INDIA

V.G.Kaliaperumal
NIMHANS, Bangalore 560 029

Health has been defined as a positive sense of well - being, physical, mental and social and not merely an absence of illness. Mental health thus is an integral component of health. Mental health statistics, therefore, must be an integral part of health statistics.

Initially the mental health services were delivered in India by large mental hospitals which were established in larger cities to meet the need of different States or regions. Mental health was not given importance in the past may be due to misconception that the prevalence of mental illness was low in India and particularly in rural India. It was also thought that there was no effective treatment for mental illness. Due to the findings in various epidemiological surveys conducted at different regions, in 1960s the need to organize general hospital psychiatry received importance. In 1975, efforts were made to integrate mental health with the general health services.

Mental Hospitals

In 1946, we had just over ten thousand beds in mental hospitals in the undivided India. The position improved and reached a figure of 12,685 in 1961. During 1975, there were 33 mental hospitals in the country having more than 20 thousand beds.

There are 45 mental hospitals in India as on today with 25 thousand beds. Majority of them engage themselves in research and manpower development besides the primary purpose of service to the needy. Specialised personnel are not available in most of the mental hospitals to collect data and analyse systematically and even to maintain medical records.

In a survey conducted by the Department of Biostatistics, NIMHANS, Bangalore, information was obtained for 36 out of 45 hospitals. The bed strength varied from 16 to 2600 per hospital. The average bed occupancy varied from 16 to 2432. Half of the beds in mental hospitals were occupied by chronic patients (duration of stay 2 years and more). The average stay was 118 days for the Indian hospitals, though this was only 55 days for all psychiatric patients at NIMHANS. On an average, each bed was occupied by three patients in Indian mental hospitals. Thus, more than 75,000 patients are treated as inpatients in India per year in mental hospitals.

Among the discharged patients, 18.6% patients were paying voluntary, 58.6% free (non-paying) voluntary, 17.2% certified, 4.8% observational and 0.8% criminals. As far as classification was concerned, 8.1% of patients were organic psychotics, 82.8% functional psychotics, 7.2% neurotics and 1.9% mental retardation. On an average more than Rs.30/- was spent for each in-patient per day. In 31 mental hospitals, more than 1.5 lakh new patients were registered with 7.1 lakhs follow-up visits in the outpatient units.

The Directorate General of Health Services, New Delhi, collects data on patients treated in mental hospitals in India. Though information is sought from every mental hospital, complete information is seldom obtained. Every year data is collected on the number of new and old patients attending adult and child guidance out-patient clinics. For in-patients, data is collected on the type of illness, outcome of treatment, age, sex and income distributions for both patients admitted and discharged. To some extent, one can obtain crude mental health indicators from these data.

Psychiatric Units

A major development in India in the area of mental health was starting psychiatric units in general hospitals. These psychiatric units have indeed become easily accessible to the general population; they have proved to be popular for short-term intervention and they were able to cater to a wide variety of disorders, including personality problems, marital conflicts, children's problems, etc. They are also seen as less stigmatising. The psychiatric units in general hospitals would have good future in the current trend of community oriented treatment.

A survey was conducted by the Department of Biostatistics, NIMHANS, on the psychiatric

facilities available in general hospitals attached to medical colleges. There were 125 medical colleges in India as on January, 1988. Out of these, 95 were run by Government of India and/or State Governments, 5 by municipalities, 2 by universities and 23 by private sector. Information was obtained from 77 (62%) out of 125 medical colleges on the availability of psychiatric units. Out of these 77 medical colleges, separate department of psychiatry was available in 52 colleges, part of the general medicine in 20 and no psychiatry facilities in 5.

Information was obtained from 78 hospitals managed by 77 medical colleges. Out of 78 hospitals, 70 were general hospitals and 8 were mental hospitals.

Out of 70 general hospitals, inpatient facilities for psychiatric patients were available in 57 hospitals. There were 1420 beds for psychiatric patients in these 57 hospitals. Thus, the mean bed strength was 25. When we compare this with the average bed strength (898) of these hospitals, 2.2% of beds were reserved for psychiatric patients in these hospitals. On an average 431 psychiatric discharges were made in these hospitals per year while the mean discharge was 25,000 for all the patients. The average hospital stay worked out to be 21 days for psychiatric patients, while it was 13.5 days for all the patients. As far as diagnosis was concerned, 7.5% patients were organic psychotics, 62.4% functional psychotics, 18.8% were neurotics, 2.1% mental retarded and 9.2% others. Out of 3.5 lakhs patients registered in general hospitals, about 3000 (0.9%) were mental patients in the outpatients departments.

When we compare the psychiatric inpatient statistics between mental hospitals and psychiatric units attached to general hospitals, the patients in general hospitals were less chronic wherein they constitute less proportion of psychotics and the duration of stay was less.

Mental health statistics available in the psychiatric ward attached to general hospitals suffer as it happened in the case of mental hospitals. Except in few hospitals, in majority hospitals the medical records department is in pooor shape. Data are not systematically maintained and even if maintained, the quality is poor. Though efforts were made to maintain systematic information, though limited, in mental hospitals and psychiatric units, the results are far from satisfactory.

Field Survey

A number of workers conducted field surveys to assess the prevalence of mental illness and its distribution. These surveys which were conducted during 1961-1982 effected the starting of psychiatric units in general hospital setting and integrating mental health with the general health.

The main epidemiological surveys were conducted in Karnataka, Tamilnadu, Pondichery, West Bengal, Uttar Pradesh, Delhi and Gujarath. The population surveyed varied from 327 to 29,468. Ther prevalence rate varied from 9.5 to 369 per 1000. Absence of a uniform and standard case finding method, poor reliability of diagnostic categorization, difference in age group studied, the nature of population and size of the populaion studied are among other things causes for the variation in the prevalence rate.

As part of a collaborative study on Severe Mental Illness sponsored by ICMR, a severe Mental Morbidity Survey was conducted in rural areas in Karnataka, West Bengal, Punjab and Gujarath. In each center about 40,000 population was surveyed using uniform method. The prevalence rate of severe mental morbidity varied from 4.6 to 14.1 per thousand population, average being 9.4 per thousand.

Thus, the epidemiological studies conducted in India indicated that at least one per cent of population at any particular point of time suffer from seriously incapacitating mental illness.

The different epidemiological studies brought out the distribution of mental illness in terms of urban, rural, male-female, age groups, etc. Even attempts were made to obtain an estimate of incidence rate.

National Mental Health Programme

The national mental health programme was formulated during 1982 and during the seventh five year plan period one crore rupees was allocated to implement the scheme. During the last one decade advancement was made in mental health which are commendable. The establishment of advance

centers and many collaborative multi-centre projects sponsored by ICMR are notable. Much success was established in understanding the mental illness as well integrating mental health with the general health. The time is not far away to get systematic and periodic data on mental health from different levels of administrative units, such as state-wise, district-wise and PHC-wise.

Conclusion

Thus, with the constant and dedicated efforts of the personnel working in mental health field, ICMR and planners at the national and state levels, we are now in a position to get mental health statistics from mental hospitals, psychiatric units attached to general hospitals, district hospitals and PHCs/ subcentres and finally from field surveys. Before the dawn of the 21st century, one would expect standardized data flowing from different levels which may help us to understand the illness in a better way and to improve the well-being of the people. ❑

SOURCES OF HEALTH STATISTICS IN INDIA

S. Muthurathnam. M.Sc.
Department of Biostatistics,
Christian Medical College, Vellore.

Vital and health statistics are traditionally the responsibility of the State Health Directorates. In a few States, however, vital statistics are transferred to the State Directorates of Economics and Statistics. Small statistical cells also operate in other branches of the health directorates, such as family welfare, maternity and child health, hospital administration, etc. At the national level, a small Statistical Bureau existed since 1937 which was reorganised in 1961 into a Central Bureau of Health Intelligence (CBHI) in the Directorate General of Health Services (DGHS) to coordinate and advise on the development of health statistics in India.

Health Statistics are mostly a byproduct of health administration both in preventive and curative aspects. Notification of communicable disease is primarily meant for prevention or control and is a source of morbidity data. Other sources relate to the hospital returns classified according to the list of 150 diseases and a number of case-finding programmes for detection of cases of specified diseases carried out on malaria, filaria, trachoma, goitre and leprosy. Apart from these, special morbidity surveys are conducted by national organisations. From January, 1982, an Integrated Health Information System has been introduced in which an attempt has been made to introduce uniform pattern of reports and records in the PHCs/Sub-Centres.

The publications related to Health Statistics from these sources are described below:

I. Publications based on Hospital returns

1. Health Information of India: This annual publication, previously known as "Health Statistics of India" is brought out by the Central Bureau of Health Intelligence (CBHI), DGHS. This publication gives data on the various aspects of health which may be classified as follows:

(i) Morbidity and mortality: Cases and deaths due to cholera and other communicable diseases-Number of mental patients and cancer patients admitted to hospitals.

(ii) Performance of national health programmes relating to malaria eradication, control of leprosy, filaria, trachoma, T.B., Cholera, goitre and applied nutrition - Incidence of malaria, blood slides examined and positive cases of malaria recorded–Number of units set up under leprosy and filaria control programmes and population at risk and estimated cases–population covered with diagnostic and treatment facilities under trachoma control programmes–Cholera combat teams set up–Prevalence rate for goitre.

(iii) Health Services: (a) Medical and Health facilities - Number of primary health centres, dispensaries and sexually transmitted diseases clinics–Number of hospitals, bed capacity, hospital bed - population ratio and number of sanctioned beds in the mental hospitals. (b) Immunisation: Number of B.C.G. Vaccinations and anti-cholera inoculations carried out–Vaccine and sera produced at various centres. (c) School Health services: Number of students examined and found defective from diseases such as malnutrition. (d) Maternal and child health services: Statistics on immunization to expectant mothers and children and prophylaxis against nutritional anaemia and blindness. (e) Laboratory services: Number of bacteriological and clinical specimens examined.

(iv) Teaching and training institutions: Number of medical colleges and training institutions for pharmacists and paramedical courses with capacity for admission, number of dental colleges, number admitted and qualified–number and admission capacity of colleges in Indian system of medicine.

(v) Medical and para-medical manpower: Number of registered doctors, dentists, pharmacists, nurses and auxiliary nurse midwives, health visitors–number of registered homeopaths and practitioners of Indian system of medicine.

The morbidity statistics presented in this publication relate to those from public hospitals only.

The data on health manpower are based on the live registers and these registers are not up-to-date.

2. Monthly Health Statistical Bulletin

This Bulletin is being published by CBHI since January 1982. It gives monthly statistical information relating to National Health programmes viz. Malaria, Leprosy, T.B., Immunisation, Diarrhoeal Diseases Control, Blindness etc. as well as reports on number of cases and deaths due to principal diseases in India. Articles on current health or health related activities are also published.

3. Directory of Hospitals

This publication is being brought out by CBHI periodically. It presents information relating to hospitals as follows:

(i) State-wise distribution of hospitals and their bed strength with rural-urban break-up according to ownership as government, local bodies, private and voluntary organisations. (ii) district-wise list of hospitals giving name and location, number of beds, controlling authority, type of hospital (general, special or with teaching facility); and (iii) hospitals maintained by police, jail, railway in each break-up and according to bed capacity. Besides these detailed information, this publication also provides a State-wise summary of hospitals, dispensaries and beds. The information given in this publication is many a time incomplete, as all the States do not send the return. The coverage of the statistics especially the extent to which private institutions are covered varies from State to State.

4. Bulletin on Rural Health Statistics in India

A quarterly Bulletin on "Rural health Statistics in India" is being regularly brought out by the Rural Health Division of the Directorate General of Health Services, New Delhi. It provides state-wise information based on latest available statistics on various aspects of rural health which may be broadly classified as follows:

(I) ESTABLISHMENT OF HEALTH CENTRES:

Establishment of sub-centres, Primary Health Centres (PHCs) and Community Health Centres-Number of PHCs & sub-centres required and in position in Tribal Areas–Construction of buildings for sub-centres and PHCs.

(II) PROGRESS OF TRAINING PROGRAMMES

Dais Training Programme-Village Health Guide Training Scheme-Alternative health Guide Scheme-Multipurpose worker Training programme-Establishment of HW (F)/ANM and HA (F) LHV Training Schools and their Training programmes.

(iii) HEALTH MAN-POWER

Number of nurse-midwives, doctors, specialists, laboratory technicians, etc. who are working in rural areas.

II. Publication based on Notification of Diseases

The publication entitled "Epidemiological Intelligence System in India" brought out by Central Bureau of Helath Intelligence, DGHS, provides useful reference material regarding notification system, quarantine administration, epidemiological investigation, public health laboratory services and relevant details of the system of collection of morbidity data on communicable diseases. The periodicity of this publication is irregular.

III. Publications from Surveys and Special Studies

The contribution of National Sample Survey for Health Statistics is by way of conducting health interview surveys for estimating prevalence and incidence rates for rural and urban areas with sex and age break-up. Average duration of sickness per spell expenditure on medicine per month per person, percentage distribution of villages having medical practitioners, average distance of the nearest hospital by population size for sample villages are the other characteristics analysed. Such surveys were conducted during the 7 -13 rounds and analysis of the data were presented in the N.S.S. report 49 (report on morbidity). Attempt was made to collect data on cause of sickness too. Besides, as part of consumer expenditure survey, information on expenditure for medicine categories by systems of medicine was collected. Few surveys were conducted in community development areas by the D.G.H.S.

As part of the control programmes for leprosy, filaria, etc., a series of surveys for case detection have been conducted.

Nutritional Anthropometry : An Appraisal

Dr. M. Lakshman,
Department of Bio statistics,
Christian Medical College, Vellore..

Anthropometry is now a widely accepted simple field technique for evaluating physical growth and the nutritional status of individuals and population groups. The most commonly used measurements are body weight and height or length which can be easily obtained. The body weight is viewed as a composite index reflecting growth in adiposity, masculature and development of skeletal system whereas height is considered as the index of cumulative physical development reflecting linear growth. As a child's growth performance reflects past nutrition and health conditions, the measurement of attained height (length) and body mass (weight) at specific ages provides useful information on the child's present and cumulative nutritional status. Subsequently, the anthropometric indices like weight-for-age and height-for-age have been incorporated into growth monitoring programmes to express growth performance.

Later it was realized that both the indices were age dependent and different techniques used to calculate and rounding off ages have caused distorted results and created problems in the interpretation of information about nutritional status of an individual or of a population. In cross-sectional surveys the use of appropriate anthropometric indicators allows the identification of the nature and extent of energy protein malnutrition in the community. Longitudinal or semi-longitudinal studies wherein repeated measurments are obtained on individuals are also useful for followup of population, comparison between groups, evaluation of programmes and for statistical comparisons in epidemiological research. To assess a child's growth at a given moment, the child's present growth (as indicated by weight or height) is compared with the growth of a reference child of the same age and sex. The median weight or height of a reference population is used as a point of comparison in calculating anthropometric status.

Despite the popularity and recognised usefulness of nutritional anthropometry in assessment of health and nutrition, there have been many discussions and conflicting recommendations about the cut-off points to be used for estimating the prevalence of anthropometric abnormality which is conventionally taken to indicate undernutrition. This confusion and the consequent lack of standard analytical methods have apparently legitimized the tendency to have every country open to set up its own criteria, depending on the local circumstances for the sake of practicality.

It is essential to distinguish the importance and relevance of growth references and standards. The reference data is used to compare and discern the relative position/status of the child/population in question. On the other hand, the mention of a standard embodies the concept of norm or target, essentially a value judgement. The question of whether all child populations throughout the world have the same genetic potential for growth in size is still unresolved. Hence, the target for one population would not be the same as the target for another.

There are three ways of relating the observed measurement to the reference.

(a) By plotting it on the centile distribution of the reference data

(b) By expressing it as a standard deviation score (Z score) and

(c) By expressing it as a percentage of the reference median.

It was recommended that for the assessment of nutritional status in cross-sectional studies, primary reliance should be placed on weight-for-height as an indicator of the present state of nutrition and on height-for-age as an indicator of past nutrition. Weight-for-age, though an effective indicator of undernutrition cannot distinguish between acute and chronic malnutrition or more appropriately

between thin and short individuals. Weight-for-age is particularly sensitive to malnutrition in children under one year of age. Other anthropometric measurements such as skinfold thickness, mid-arm-circumference and head circumference have also been used to measure the nutritional status of individuals. The skinfold thickness gives information about body composition which is additional to that given by weight. Arm circumference and Head circumference are generally regarded as proxies for weight and height in individuals.

Wasting indicates a deficit in tissue and fat mass compared with the amount expected in a child of the same height or length, and may result either from failure to gain weight or from actual weight loss. It may be precipitated by infection or some other household crisis. One of the main characteristics of wasting is that it can develop very rapidly and under favourable conditions can be restored rapidly. The prevalence of wasting is greatest between 12 and 24 months of age when dietray deficiencies are common and diarrhoeal diseases more frequent.

Stunting signifies slowing in skeletal growth. The growth rate may be reduced from birth but a significant degree of stunting, representing accumulated consequences of retarded growth, may not be evident for some years. It is found to be associated with poor economic conditions, repeated infections and chronic inadequate nutrient intake. These children adopt to the condition on long run by reducing their need for nutrients resulting in growth failure.

To estimate the prevalence of children with wasting and stunting in populations the cut off points of -2 S.Ds. of the reference median for weight-for height and 90% of the reference median for height-for-age could be used effectively. On biological, epidemiological and statistical grounds wasting and stunting are two different processes of malnutrition. Both weight-for-height and height-for-age account for 95% of variation in weight-for-age meaning that weight-for-age represents the sum of information given by the other two indices.

Though body weight in many populations is normally distributed and adoption of a cut off point like less than –2 S.Ds. or less than 80% of the reference median value to identify the proportion of undernourished is a reliable method it should be borne in mind that any child with low weight for a given age need not necessarily a malnoursihed one. It could be that:

- It was a low birth weight baby either because it has suffered from malnutrition or born prematurely or because it was born to small parents.
- the mother might have suffered malnourishment during pregnancy, or
- the child had previously suffered a period of undernutrition and failed to catch up growth.

In India, "the need for Growth norms and Development standards" necessiated ICMR to carry out the multicentric survey during 1956-65 with the objective of constructing 'standards' of growth and physical development of Indian children for the country as a whole and for each of the States. The results were summarised and published (ICMR 1972).

Thereafter, National Institute of Nutrition, Hyderabad had carried out a number of investigations focussing on child growth and development; the major thrust was on topics like growth in malnourished children; growth in children from well-to-do families; methods to estimate the prevalence of malnutrition in populations; law-like relationship between body weight and height in child populations, etc.

At present almost all the teaching Hospitals routinely collect anthropometric data from the child population to which it caters and use them to estimate the prevalence of malnutrition and also to make policy decisions on how to improve nutritional status of the concerned.

As far as the Christian Medical College Hospital, Vellore is concerned besides department of Child Health, Community Health and Rural Unit for Health & Social Affairs (RUHSA) whose objectives are limited and specific, Department of Biostatistics under the dynamic leadership of Prof. P.S.S. Sundar Rao has been carrying out research projects funded by National and International agencies for the past two decades on varied aspects of Growth and Development the details of which have been explained in Page 7.

VIII ANNUAL CONVENTION OF

THE INDIAN SOCIETY FOR MEDICAL STATISTICS

NOVEMBER 1 — 3, 1990

ABSTRACTS

DEPARTMENT OF BIOSTATISTICS

CHRISTIAN MEDICAL COLLEGE

VELLORE-632002

INDIA

1. STRENGTHENING MCH CARE RELATED HEALTH INFORMATION SYSTEM IN RURAL AREAS BY COMMUNITY INVOLVEMENT THROUGH MAHILA MANDALS

THOMAS VENGAIL CHACKO

PSG Institute of Medical Sciences, Coimbatore

In the existing system of Collection of Health Information on Maternal and Child Health and Family Planning, there are some shortcomings like inadequate coverage and problems of accessibility and reliability of health information. This hampers microplanning at the peripheral level. This, to a certain extent can be supplemented by Organised Community participation. Mahila mandals in every village can be involved to act as grassroots source of Health Information and to provide feedback on health service utilization and acceptability.

Areas, Indicators & Modalities have been identified here where Mahila Mandal Members can contribute to the Rural MCH Health Information system. This will work effectively when they are involved in Community based Maternal and Child health care using a Home Based Mother Record.

In the PSG IMS field practice area of the Department of Community Medicine at Vedapatti, we have achieved increased Health awareness and MCH and Family Planning acceptance using Mahila mandal members under the FPAI-PSG IMS Integrated Rural Family development project at Vedapatti which has motivated formation of 48 Mahila Mandals spread out in 52 villages. Their role in Rural Health information system envisaged here will be shortly implemented under a "Community-Based Maternal & Child health Care" Project.

2. TOWARDS DEVELOPING INFORMATION SYSTEM ON CHILD SURVIVAL AND DEVELOPMENT

R. K. GUPTA

National Institute of Public Cooperation and Child Development, New Delhi.

The National Policy for Children enunciated in 1974 by Government of India recognising children as the 'nation's supremely important asset' and responsibility for their 'nurture and solicitude' envisages the nation's commitment to survival and development of its children. Information system encompassing timely collection, compilation and analysis of the data on key indicators of child survival and development and its dissemination to policy makers, planners, researchers and administrators concerned, is of crucial importance as an integral part of national endeavours to promote child survival and development. This will help in assessing the progress as well as identification of areas which require special further attention. An attempt is being made at National Institute of Public Co-operation and Child Development, New Delhi in this direction under the project 'Child in India – A Statistical Profile'. This profile would cover information pertaining to various sectors of child survival and development viz. Demography, Vital Statistics, Health, Nutrition, Education and Welfare Services. Various indicators and relevant sources of data collection have been presented and discussed in the present paper.

3. HEALTH INFORMATION SYSTEM: A BIOSTATISTICIAN VIEW

ANIL KUMAR

Regional Medical Research Centre, Bhubaneswar

The collection of health information is vital for health care planning. There are various sources existing to collect information on health such as morbidity and mortality by cause but the coverage of events varies. This affect the reliability and its usage for planning health care delivery system.

This paper is an attempt to examine the purpose, limitations and how best the available information from District Health System can be used for the assessment of health situation at district level. This paper also discuss the relative importance of causes of deaths data collected under model registration scheme by Registrar General, India and suggest some modifications for its improvement.

4. DATA MANAGEMENT UNDER LONG TERM EPIDEMIOLOGICAL STUDIES: A CASE OF BHOPAL GAS DISASTER

S. N. DWIVEDI AND M. P. DWIVEDI

Bhopal Gas Disaster Research Centre (ICMR), Bhopal

A cohort consisting of about 80,000 population from affected area and about 20,000 population from control area has been registered for scientific studies at Bhopal. The basic unit of approach to identify any individual is locality number, family number i.e., ICMR number and its identity number in the family. A large number of epidemiological studies covering various aspects of human health have been started since the year 1985. The data under these studies are being collected regularly on specific intervals. These studies are mainly based on registered cohort. However, some of the studies are totally based on the individuals selected from other sources like hospitals or irrespective of cohort based on certain criteria. In addition to the analysis of data collected under each study, one of the important tasks is to find out those persons who have been studied under multiple aspects so that possible correlations/ associations may be established. All the data are being managed through computer. In the present paper, attempts have been made to enumerate all possible problems being faced from time to time in management of the data and their possible solutions.

5. COMPUTERS IN HOSPITAL MANAGEMENT

I. M. S. LAMBA

Institute for Research in Medical Statistics (ICMR), New Delhi

Hospital management is a complex task with multidimentional activities centred around patient care. In this system one action may result in several predictable or unpredictable reactions. Management of these activities has further become complicated with manifold periodic increase in

the number of beneficiaries against nominal increase in the hospital budget and other resources. The problems being faced by doctor pertaining to diagnostic appointments for sophisticated machines, allotment of beds, surgical schedules and maintenance of medical records can easily be solved by the use of computers. In the past high cost profile of computers could not attract the management of Indian hospitals even in private secotrs. But with the advent of low cost personal computers it has become feasible to enter into this arena of computers for the betterment of patient care. In this paper an attempt has been made to explain the concepts of System Approach in the use of personal computers for hospital management. The whole system has been segmented into small independent but interrelated sub-systems. This design is applicable both for a multi-user and multi-tasking main frame systems as well as for PC – Network environment for Rural and District Health Information System.

6. STRATEGY OF RURAL TRIBAL HEALTH INFORMATION SYSTEM IN INDIA

P. K. SIRCAR

Research Centre International, Ardeer Hospital, Bihar.

Since Neolithic age native communities of India are surviving in the hill forest sector as minority weaker groups and migratory races spread at the river planes of river valleys. Now India has 51,628,638 tribes divided in 260 groups (93% are rural).

In India 60 – 70% population still using traditional medicines, but in the Health information system, Block reports are collected by the District Health Department and they send it for national statistics. We have 87 beds and 39 Medical Officers per lakh population (1985). There are 557137 villages and about 900 (Average) population per village. As rural people normally depend upon traditional treatment, and we have no true data of illness or system. So data of diseases and death jumped as stated Gujrat in 1977 high and 1978 low. All India data of Ayurveda Bed 10879 in 308 hospitals are mostly located in urban and small towns. Most of the tirbes maintain their own system, which they have adopted in their norms and values, only a few visit in many Mission Hospitals where they get sympathetic behaviour. According to P. Padmanabha (1980) very little information related to child mortality, health services are available, so SRS has been organised in 3666 units (2338 rural). But we do not find separate tribal data.

Therefore, some university scholars, and Institute research persons made field studies at some tribal settlement, but there are no national data. Birhor are most primitive tribes of Bihar and Health and Welfare Project was organised by author as per cooperation of FPAI Gomia Branch. Feasibility survey was done in 1973 and services and studies made 1974–75 to 1981. Blood, urine, stool test was organised at settlement (Tanda) but comparative study could not be done as no other person did such job among the Birhors.

'Naya' is the nominated Birhor who did all magic to satisfy Natural Gods (Bonga). But they accepted all our services in 8 Tanda. Detail studies to be made on their system and type of acceptance of modern treatment wherever needed by trained persons.

7. AN INVESTIGATION OF THE WHO 30 - CLUSTER SURVEY METHODOLOGY IN MADRAS CITY

B. N. MURTHY, S. RADHAKRISHNA, R. EZHIL & S. VENKATASUBRAMANIAN

Institute for Research in Medical Statistics, Madras.

The World Health Organization (WHO) has been advocating since 1978 a 30-cluster sample survey with 7 children in the age-group 12–23 months per cluster, for estimating immunisation coverages with a 95% confidence interval of ± 10 percentage points. Surveys using this method have been carried out in several countries, and a review of these by Henderson and Sundaresan indicated that the method was fairly satisfactory but that there was scope for improvement. Keeping this in mind, a 60–cluster sample survey with 15 children per cluster was undertaken in Madras City in 1989, to facilitate a review of various combinations of the number of clusters and cluster size. The immunisation coverages were of the order of 80% each for DPT, Polio and BCG vaccines, about 50% for measles vaccine and approximately 40% for coverage with all the four vaccines. The 95% confidence intervals varied from ±3% to ±4%, and were well within the desired value of ± 10%. The corresponding results for the WHO recommended method of 30 clusters with 7 children per cluster also yielded acceptable 95% confidence limits of ±6% to ±8%. Other combinations of number of clusters and cluster size that yielded 95% confidence intervals of ±10 percentage points were 20x6, 25x5, 30x4, 40x3, 60x2. The design effect was approximately 1.25 in Madras City, as compared to 2 that is assumed in WHO methodology for rural and urban areas combined.

8. USES OF MEDICAL RECORDS TO EPIDEMIOLOGISTS – A CASE OF BHOPAL GAS DISASTER

M. P. DWIVEDI AND S. N. DWIVEDI

Bhopal Gas Disaster Research Centre (ICMR), Bhopal

After the Bhopal Gas Disaster in the night of 2nd/3rd Dec., 1984, Indian Council of Medical Research requested a large number of scientists especially epidemiologists to meet at Bhopal for proper planning of long term epidemiological studies which may help administrators to estima e the number of patients suffering from a particular disease from time to time who need a particular treatment. In absence of proper medical record system at Bhopal, they could not collect the basic information on existing pattern of diseases in the toxic gas exposes creating difficulties in planning of studies. This paper describes the value and uses of medical records in epidemiology which suggests that all health institutions need to keep adequate records.

9. HOUSEHOLD COMPOSITION AND CHILD SURVIVAL IN TWO CORPORATION DIVISIONS OF MADRAS CITY

L. SUNDARAMOORTHY, M. KACHIRAYAN, GRACE MARIA AUGUSTINE, V. PERIANNAN, R. THANGARAJA JOSEPH & VASNA PUSHPARAJ

Institute for Research in Medical Statistics, Madras.

Based on a fertility survey data, this paper examines the association between the presence of elder children, particularly female children, and elders other than the parents in the household on chi d survival. Other factors like, socio-economic status of the household, paternal and maternal characteristics of the index child care controlled. Logistic regression analysis is employed.

10. A TWO-STAGE DESIGN FOR CONTROLLED CLINICAL TRIALS WITH BINARY OUTCOMES

B. KISHORE KUMAR, M.C. SATAGOPAN & V. SELVARAJ

Institute for Research in Medical Statistics, Madras.

Most clinical trials of a new treatment and a standard treatment have a predetermined size which is based on the approximate efficacy of the standard regimen, the minimum superiority of the new regimen that is of practical interest, the Type I error and the 'Power'. The intake period to the trials is often very long (sometimes years), but the outcome measure (success or failure) may sometimes be obtained relatively quickly – for example, control of blood sugar values by 3 months in patients with Diabetes Mellitus, passing of stones by 3 months in patients with ureteric stones, return to normality (both clinical and biochemical) within a month in patients with Viral Hepatitis. In such situations, it is possible that interim analysis of the data might sometimes indicate that the new treatment regimen is not proving to be more effective than the standard, in which case continuation of the trial may pose ethical problems, as well as unduly delay the start of further trials with increased dosages or alternative regimens. Methods are now available for computing the trial size for such situations. A two -stage procedure is employed and two values of the trial size (n and N) are computed. If the new treatment is not significantly better than the standard when n outcomes are available, the trial is terminated. If it is better, the trial is continued until all N outcomes become available. With this procedure, the expected trial size would be 25% less than the conventional trial size, with minimum loss in 'Power'. Application of this method is illustrated with reference to controlled clinical trials on traditional remedies that are being monitored by this Institute.

11. ESTIMATION OF CANCER POPULATION IN INDIA

H. D. GUPTA & T. N. SHARMA

Postgraduate Institute of Medical Education and Research, Chandigarh.

A probability model has been developed for estimating cancer population in India. The information needed is total population size and number of deaths by cause. The latter information is available from certificate of cause of death. The model can be applied for estimating prevalence of any irreversible disease.

12. THE LIMITATIONS OF SIGNIFICANCE-TESTING AND THE ADVANTAGES OF CONFIDENCE INTERVALS

S. RADHAKRISHNA, P. JAYABAL & B. N. MURTHY

Institute for Research in Medical Statistics, Madras.

Excessive use of hypothesis-testing and equating statistical significance to the presence of an effect and nonsignificance to its absence frequently results in misinterpretation of data. It is shown with real-life examples that clinically appreciable differences may be overlooked because they are not statistically significant, when the latter finding is due to inadequate sample size. Conversely, much ado may be made about clinically insignificant differences merely because they are statistically significant. In medical studies, the investigator is more often interested in determining the magnitude of an effect rather than in simply stating significant or nonsignificant. Confidence intervals are an attractive alternative and have become increasingly popular in medical journals, because they give a range of values in which the population value of the difference may lie. The benefits of employing the confidence interval approach are illustrated with real-life examples in clinical trials, community intervention studies in a disease control programme, epidemiological studies and laboratory investigations.

13. CONFIDENCE LIMITS FOR BINOMIAL PROPORTION

R. JAYASRI & N.G.K. NAIR

Institute for Research in Medical Statistics, Madras.

The formula conventionally employed for determining the confidence interval for a binomial proportion is $p \pm Z_{\alpha/2} pSEp$. Though this expression is easy to compute and used universally, it underestimates the true interval; also the method fails if $p = 0$ or 1. Again, this formula always results in limits which are symmetrical about p, whereas the true limits, as determined by the Exact method, are asymmetric except when $p = 0.5$. The Exact method, however, is iterative and time-consuming, and not easy to employ if computer facilities are not available. Consequently, several authors have attempted to evolve non-iterative approximations, which yield asymmetric confidence limits closely similar to those produced by the Exact method and which can be employed even if $p = 0$ or 1. The findings are presented with these methods for a wide variety of values of n and p and recommendations made.

14. TRANSIENT BEHAVIOUR OF SIMPLE STATE DEPENDENT BIRTH DEATH PROCESS

O.P. SHARMA AND N.S.K. NAIR

Indian Institute of Technology, New Delhi & National Institute of Immunology, New Delhi.

This paper studies the transient behaviour of a finite state arbitrary birth death process when birth and death rates are state dependent. The explicit expression for the transient state probabilities are obtained in terms of the eigenvalues of a symmetric tridiagonal matrix.

15. A COMPARATIVE STUDY OF NON-PARAMETRIC CENSORED RANK TESTS IN THE ANALYSIS OF TUBERCULOSIS SURVIVAL DATA

VENKATESAN, P. VISWANATHAN, K. AND PRABHAKAR, R.

Tuberculosis Research Centre, Madras, and Dept. of Statistics, University of Madras.

The statistics used most frequently to form two sample tests in the analysis of survival data are the Mantel-Hanszel's (1959) statistic, Gehan's (1965) generalised Wilcoxon statistic, Prentice's (1978) generalised Wilcoxon statistic and generalised Kolmogorov-Smirnov statistic by Fleming et al (1980). In this paper, an application of the above tests to one of the pulmonary tuberculosis trial data consisting four treatment groups is considered and the test results are compared. The pairwise comparisons of the treatment groups using the test results lead to different conclusions. Also the results are compared with survival curves and difference in the inferences based on the test results are explained from an application viewpoint.

16. A COMPARISON OF MARKOV MODEL TO LIFE TABLE IN THE ANALYSIS OF MEDICAL SURVIVAL DATA

VENKATESAN P. AND SOMASUNDARAM, P. R.

Tuberculosis Research Centre, Madras.

A Markov model of tuberculosis prognosis was evaluated by comparing the duration of disease activity and disease life expectancy with Kaplan-Meier survival curves. A four state Markov chain was constructed to determine the transition probabilities between disease states. The proportion of patients population in each disease state over time provided a convenient summary of the disease under treatment conditions that supplemented the Kaplan-Meier survival curves. A Markov model yields a useful description of outcome for multistate diseases that supplements survival curves. In this paper we compare and construct Markov model and survival curve analysis using data from a tuberculosis trial and discuss their advantages and limitations.

17. A SEMI-PARAMETRIC APPROACH FOR MODEL SELECTION IN SURVIVAL DATA ANALYSIS

VISWANATHAN K., VENKATESAN P. AND PRABHAKAR R.

Department of Statistics, University of Madras and
Tuberculosis Research Centre, ICMR, Madras.

This paper presents an account of an unified approach for model selection procedure based on the semi-parametric approach (Olkin and Spcigelman, 1987) and the principle of coherence (Edwards and Havranek, 1987) in survival analysis. The key idea proposed is to fit a combination of the parametric and non-parametric estimates, namely

$$g(t, phi) = phi\ f_1\ (t, thêta) + (1-phi)\ f_2\ (t)$$

where (theta$\leqslant$phi$\leqslant$1) is unknown and estimated from the data using pseudolikelihood approach. If phi is close to 1, then the parametric model prevails and if phi is close to 0, then the data throws more weightage on non-parametric component. The procedure is applied to a extra-pulmonary tuberculosis data by taking the parametric component as generalised gamma and non-parametric component as Kernal estimate, Kaplan-Meier estimate and splines and the results are discussed in the paper.

18. RELATIVE RISK — AN INSTRUMENT FOR EVALUATION RESEARCH IN LEPROSY

P. SIRUMBAN AND P.S. RAO

Central Leprosy Teaching & Research Institute, Chengalpattu.

Relative Risk serves as an indicator measuring the strength of association in cause effect design and is held more suitable for cross sectional data. Leprosy is a public health problem, where, though several riddles remain unsolved, various intervention programme is being implemented. Due to the fact that the outcome is only an overtdisease in humans, the planners often handicapped with measurement problem in evaluation.

With the limited knowledge in the field of leprosy the statistical measure RR could reasonably serve as an indicator to compare with the popular observations, under certain assumptions.

The paper discusses the validity of the assumptions by applying to three cross sectional survey information, that immediately preceding and that followed after implementation of Intervention, viz., Multi drug therapy.

19. SUCCESSIVE SAMPLING-GENERALISED ESTIMATION PROCEDURE

PADAM SINGH AND R.J. YADAV

Institute for Research in Medical Statistics (I.C.M.R.), New Delhi

Generalised estimation procedure has been attempted in the paper under successive sampling. It has been shown that the estimation of mean for recent occasion, Change over occasions and average of several occasions are particular cases of the proposed generalised estimation. The optimum value of Replacement fraction has also been calculated and the usefulness of the results are illustrated with the help of numerical illustration.

20. EFFECT OF VARIATIONS IN SAMPLE SIZE ON PREDICTOR VARIABLES OF BODY WEIGHT

K. VISWESWARA RAO AND N. BALAKRISHNA

National Institute of Nutrition (ICMR), Hyderabad.

The effect of variations in sample size on the best set of anthropometric measurements related to body weight was done with the data available on nutritional anthropometry of pre-school children. Measurements of height, weight, arm length, circumferences of head, chest, arm and calf and fat folds at triceps and calf were taken on all children. Samples of size – 25, 50, 75, 100, 150 and 200 were taken. The multiple regression models of body weight with all other anthropometric measurements were fitted by the method of least squares. The best set related to body weight was chosen by the stepdown multiple regression procedures where all the partial regression coefficients of predictor variables are significant and the multiple correlation coefficient and Hotelling T^2 values of the model are as those of the model with all the measurements. The results indicated that the best set of variables related to body weight which include height and circumferences of head, chest, calf and arm were found to be same with samples of size 100 or above. Variations were observed with samples of small in number. Variations in best set related to body weight by age and sex were also studied. The results will be presented and discussed.

21. LOG-LINEAR ANALYSIS FOR BIRTH ORDER AND OBSTETRIC COMPLICATIONS IN A DELHI SLUM

A. INDRAYAN, O.P. AGGARWAL AND A.T. KANNAN

University College of Medical Sciences, Delhi.

Purpose: To investigate relationship of perceived obstetric complications with birth order in a low socio-economic community of a developing country using log-linear analysis.

Methods: Detailed interview in the month of April and May 1989 of parents of all 414 births taking place from 1st January 1989 to 31st March 1989 in a Delhi slum with a population of nearly 60,000. Log-linear analysis of data to remove the effect of other associative factors.

Results: The common natal complications reported are prolonged labour (18.1%) and excessive bleeding (8.7%). The common post-natal complications reported are puerperal sepsis (17.2%), convulsions (16.4%) and UTI (12.6%). All these were reported almost as often in higher order births as in lower order births. Higher order births were found associated not only with older age of the mother but also with higher illiteracy and poorer ante-natal care. When the effect of these factors is removed, both natal and post-natal complications showed declining trend with increasing birth order.

Conclusion: The common obstetric complications perceived by the low socio-economic community of a developing country apparently are uniform for all order of births but in fact decline with increasing birth order when the effect of other associative factors is removed.

22. PREDICTION OF OUTCOME OF SCHIZOPHRENIA

NARENDER KUMAR VERGHESE A., RICHARD J., SETHI B.B.,
RAJKUMAR DUBE K.C., MENON S., PARHEC R., PRABHAKAR A.K.

Indian Council of Medical Research, New Delhi.

The paper presents the results of prediction analysis of the fifth year follow up of a multicentred study on factors associated with course and outcome of schizophrenia. The multiple discriminant function analysis yielded two discriminant functions to classify cases into best, intermediate and worst outcome groups. The classification of cases into outcome categories using this method was in agreement with the overall outcome assessed by the clinician on a number of criteria in majority of cases. The paper also presents a graphical method for predicting the outcome of schizophrenia. This method is based on distribution of discriminant function scores, and does not make assumptions of normality and equality of variance. The overall performance of this method was not much different from that of multiple discriminant function analysis, but it is more convenient to use this method for classification problems.

23. ASSESSMENT OF RISK OF FETAL LOSS

K. G. SELVARAJ AND P. S. S. RAO

Department of Biostatistics, C M C, Vellore.

Risk assessment has become an important managerial tool in efficient health care administration as it effectively utilizes limited resources by defining priorities.

Relative Risk (RR), a traditional measure of association indicates excess risk when RR greater than one, moderate hazard when ranging from 1.7 to 2.6 and strong hazard when the value exceeds 2.6.

Relative Risks were obtained for risk factors of commonly collected through field survey and graded for risk from data of early fetal losses and total fetal losses of prospectively followed women in both rural and urban areas of North Arcot district, Tamil Nadu.

The other indicators of risk assessment were computed and the results were compared in this paper.

24. A MULTIVARIATE ANALYSIS OF PNEUMOCONIOSIS RISK ASSESSMENT IN AGATE WORKERS: COMPARISON OF DISCRIMINANT FUNCTION AND MAXIMUM LIKELIHOOD APPROACHES

N. MATHUR, S.K. MANDAL, MUKESH SRIVASTAVA & B.N. GUPTA

I.T.R.C. and C.D.R.I., Lucknow.

A multivariate logistic model for measuring pneumoconiosis risk is described. The linear discriminant approach (Truett et. al. 1967) was used to estimate the logistic coefficients. Age, Pack year and Dust year was considered as independent variables which correctly classify 96 percent cases of pneumoconiosis.

In the second stage the estimates of the logistic coefficients were estimated using an iterative Maximum Likelihood approach given by Walker and Duncan (1967). The programme for logistic regression was provided by Daniel L. Megee (1986). The two approaches were compared emperically.

25. CROSS-VALIDATED DISCRIMINANT MODELS OF BINARY DATA FOR PREDICTING SURVIVAL IN BURNED PATIENTS

BISHWANATH MUKHERJEE AND AMARJIT SINGH BHATIA

Indian Statistical Institute, Calcutta and Central Jalma Institute for Leprosy, Agra.

This paper reports a case study in the use of different methods of discrimination procedures for binary data for classifying survivors among 961 patients (cross-validational sample) who were treated for burn injury between May 1976 to October 1977 in different hospitals located in five major cities of India. These techniques were initially used for predicting survival rates on the basis of information on the involvement of six major body parts obtained from 562 cases admitted to a Lucknow Hospital (Training Sample) during April 1970 to April 1976. The primary goal of this work was to derive a prediction system in which the error rates for comparable binary data obtained from both training and test samples would be low.

The results show that in both the samples, the logistic regression and the full multinomial models were found to be impressively superior to linear discriminant (LDF) and nearest neighbourhood (NN) procedures. In the test sample, the error of misclassification was about 17 per cent for the former group of procedures and about 27 per cent for the LDF and NN model. Even for the training sample, the LDF showed about 19 per cent error and the NN showed about 10 per cent error. In each case, the error rate was higher for false positives (predicted alive but actually died). Some implications of the findings are discussed. The advantages and disadvantages of the logistic models for medical diagnosis and prognosis especially when the dichotomous variables under study have interactions are also discussed.

26. A MULTIVARIATE APPROACH TO THE STUDY OF SOCIO-ECONOMIC DETERMINANTS OF LEPROSY

V. SARAVANABAVAN AND S. SHANMUGANANDAN
Madurai Kamaraj University, Madurai.

Leprosy is a chronic infectious disease caused by mycobacterium leprae. Leprosy is a major socioeconomic problem in India. It is continued to be one of the major health problems in India. Tamilnadu is one of the leading States to witness the high prevalence rate of leprosy. There were 15 leprosy affected persons for every 1000 against the national average of 5/1000. Whereas the prevalance rate of the leprosy in Madurai is 20/1000. Since leprosy forms one of the major social problems in Madurai city, the present study is an attempt to analyse the socioeconomic determinants of leprosy with reference to a case study from Madurai city. The purpose of this present research investigation is to identify the major socioeconomic determinants of leprosy with the help of application of a multivariate analysis known as multiple regression analysis. The multiple regression analysis has also made an attempt to construct a statistical model to explain the inter relationships between the prevalence and incidence of leprosy and socioeconomic variables.

27. RISK FACTORS IN INFANT MORTALITY — APPLICATION OF LOGISTIC REGRESSION AND RECEIVER OPERATING CHARACTERISTIC CURVE

L.K. SAMUEL AND L. JEYASEELAN
Christian Medical College, Vellore.

Infant mortality depends to a large extent on maternal and biological factors. As part of a longitudinal community study done prospectively during 1969–'74 in and around Vellore, Tamil Nadu, several aspects of fetal and infant growth had been studied. In the present paper, the influences of certain maternal characteristics on infant mortality are examined using multivariate logistic regression analysis. Goodness of Fit Statistics (Lemeshow and Hosmer, 1982) were computed and the results compared with Receiver Operating Characteristic (ROC) Curve approach to assess 'Goodness of Fit'.

28. ESTIMATIONS UNDER STRATIFIED RANDOM SAMPLING FOR CASE – CONTROL STUDIES

T.C. GUPTA
ICMR, New Delhi.

A case control study is a type of observational analytic epidemiologic investigation in which subjects are selected on the basis of whether they do or do not have a particular disease under study.

The groups are then compared with respect to the proportion having a history of an exposure or characteristic of interest. Because of this design case-control studies offer a number of advantages for evaluating the association between an exposure and a disease. A variety of sampling procedures can be used for the selection of cases and controls. The objective of any sampling procedure is the avoidance of a biased selection. It is intended to avoid the over representation or under representation of exposed cases and exposed controls in the study at hand. Sampling considerations per se are often most pertinent to the selection of the control group, since with non-communicable diseases the number of eligible controls available for study exceeds the number of cases. In practice, sampling procedures for the selection of cases and controls are implemented in diverse ways.

The statistical aspects related to planning of epidemiological studies include choice of an appropriate research design and a sampling scheme. In this paper an attempt has been made to investigate the role of sampling in planning the case-control studies. The results for stratified random sampling have been derived for estimating the relative risk. The optimisation problem has been discussed and sample size determined in such situations. Formulae for variance have been derived and gain due to stratification in case-control studies is also discussed. The methodology has been illustrated with examples from a study of relationship of myocardial infarction with smoking and recent use of oral contraceptives among women.

29. APPLICATION OF MULTIVARIATE ANALYSIS IN THE IDENTIFICATION OF MAJOR DIMENSIONS OF HEALTH AND DISEASE: A CASE STUDY

S. SHANMUGANANDAN

Madurai Kamaraj University, Madurai.

Health is defined as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. The interactions of host, agent and environment may produce three results; disease, no disease or signs of illness that reduce functional ability. Health and illness are mutually exclusive. It is possible, however for disease to occur without illness because health and disease are not mutually exclusive. The spectrum of health is multidimensional – anthropological, biological, psychological, economic and even political. The illness is environmentally determined. The isolated societal elements of poverty inflation, unemployment, urban transportation, housing, ethnic conflict, crime, drug abuse, street accidents, neighbourhood conflicts and family problems are in reality major aspects of environmental health. The present study analyses the distribution of major diseases of rural areas of Madurai district with reference to disease classification and attempts to bring out the major dimensions of health and disease in relation to environmental, demographic, socioeconomic and sociocultural and health care variables, with the help of application of multivariate statistical technique 'Factor analysis'. The factor scores are derived for different areas and possible associative and causative factors are understood. This offers an explanation for conceptualising the role of major dimensions of disease and health.

30. POLYTOMOUS LOGISTIC MODEL FOR MATCHED PAIRS CASE-CONTROL DESIGN: STUDIES WITH COVARIATE

S.S. GANGULY

Armed Forces Medical College, Pune.

Pair-wise matched case-control design is commonly used in epidemiological analysis for estimating odds ratios. In the most simplest situation, each subject is classified according to a binary outcome and the factor of interest being a two-level factor. Binary logistic models have been found to be very useful for studying such relationship. In our earlier studies we have shown that polychotomous logistic model can be used for estimating odds ratios when the exposure of prime interest assumes multiple levels. In this paper, using the above model, the odds ratios for the possible levels of risk factor of interest is estimated, adjusting for covariates which were not included in the matching process. An illustrative example is presented and discussed.

31. ON INTERACTION EFFECTS IN A CASE CONTROL STUDY OF CERVICAL CANCER

L. SATHYANARAYANA, N.S. MURTHY, A. SEHGAL & U.K. LUTHRA

ICPO, New Delhi.

Interaction among variables exist when the relationship of interest varies according to the level of one or more co-variates. In order to study the interaction effects among the variables associated with development of cervical cancer, data on 68 cancer cases alongwith five randomly selected controls for each case were obtained from uterine cervical dysplasia study part I. The variables considered were presence of local infections, cervical erosion, age at consummation of marriage, education of women, parity and religion. The assessment of second order interaction were made with the help of three way tables and their additive and multiplicative effects were determined. For infections and cervical erosion the odds ratios were 1.0, 1.4, 4.2 and 11.9. Both on additive and multiplicative scales interactions were present. Further it is observed that the relationship of infections with cancer of cervix varies with levels of age, age at consummation of marriage and education of woman. With other variables no interaction was found to be present.

32. FERTILITY ANALYSIS BY THE STANDARDIZED MULTIPLE REGRESSION APPROACH

A.S. SINGH, R.N. MISHRA AND S.D. BHARDWAJ

B.H.U., Varanasi.

Growth of human population puts enormous pressure on many aspects of a nation's economy. Management of fertility behaviour of a couple or community depends upon a host of factors including social & economic values to child birth, traditional customs and beliefs, infant and child mortality,

religious bindings, availability of contraceptive advice and services and more. All these, in turn, are influenced by such factors as income and literacy level of family especially that of mothers. In this paper we have attempted to high light the effect of infant mortality, famale literacy, females employment and female age at marriage on the crude birth rate. **The method of path analysis which is standarised multiple regression analysis has been adopted and to find out the direct and indirect effects**. The method has been applied to the data of 14 major states of India [SRS–1986, RGI].

33. LINEAR CAUSAL ANALYSIS IN POLIOMYELITIS EPIDEMIOLOGY

V.P. CHODANKAR

H. F. Society, Bombay.

The purpose of this note is to elucidate the role of birth-rate (X_1) and relative humidity (X_2) in the spread of paralytic poliomyelitis (P) in Greater Bombay (GB). Included in the path analysis strategy is infant mortality (X_0) as well because its inverse relationship was demonstrated by the present author (Chodankar and Dave J. Indian Medical Association, July 16, 1979) in the disease epidemiology. Fifteen data points of each variable were used in finding correlations from grouped data, the groups pertaining to the years 1960–66 and 1967–74 since 1967 was a change point. Considering the two self-contained subsystems in the proposed path diagram, multiple correlation coefficients were $R_0(12) =$ Sq. root of 0.403, the residual path 0.773 accounting for the influence of unknown variables on X_0 outside of X_1 and X_2 and $R_p(012) =$ Sq. root of 0.819, the corresponding residual path being 0.425. Thus infant mortality with $R_{P0} = -0.779$ and $P_{P1} = 0.099$ and $P_{P2} = -0.617$, the path respectively from birthrate and relative humidity exerts overwhelming effect on P. The direct path from X_1 to P is positive but small whereas its indirect effect to P via X_0 viz. $(0.6372)(-0.7792) = -0.4965$, is large but negative. Thus declining birth – rate, aftermath of successful family planning programme pursued vigorously since 1967, has paradoxically rendered the defense mechanism of well-cared for babies inadequate to cope with the onslaught of polio virus infection resulting in paralysis. This deduction is predicated on the experience of developed countries. The proliferation of polio viruses may presumably be the handiwork of relative humidity, a speculation based on the value of the path coefficient ($= -0.617$) but needs experimental evidence. Its indirect effect via infant mortality is $(0.0126)(-0.7792) = -0.0098$ which may be non-significant. Thus its direct path alone contributed to the unfavourable trend of P.

In sum, both relative humidity and birth-rate play a significant role in the epidemiology of P, the latter due to an improved environment and the former by multiplication of the causative organism in the environment. It has also been demonstrated by considering the trinity X_0, X_2 and P that there is no common factor underlying them, thus reinforcing our inference above. The corrollary is that owing to these three causative factors acting in consort, the trend of P has been exponential (vide reference cited above) rather than linear.

34. INFLUENCE OF MATERNAL AND CHILD HEALTH CARE ON INFANT SURVIVAL IN A LOW-INCOME URBAN AREA

M. K. ACHIRAYAN, R. THANGARAJA JOSEPH, V. PERIANNAN,
V. KSELVARAJ AND VASNA PUSHPARAJ

Institute for Research in Medical Statistics, Madras.

This paper uses fertility survey data to examine the effect of antenatal, natal and postnatal care variables, both medical and non-medical, on infant survival, after controlling for the effects of various socio-economic factors. The conceptual model proposed by Mosley and Chen is adopted, and logistic regression analysis is used to determine the effects of the different variables.

35. IMMUNIZATION STATUS IN RURAL AND URBAN AREAS OF DISTRICT WARDHA, (M.S.)

M.S. BHARAMBE, N.K. TYAGI AND K.K. GHULIANI

M.G. Institute of Medical Sciences, Wardha (M.S.)

Evaluation of immunization coverage in rural areas of District Wardha and in Wardha city were undertaken from 28–4–88 to 20–5–88 in rural areas and 6–2–89 to 3–3–89 in urban areas. Forty village from PHC's Anji, Seloo and Bhidi were drawn using simple random sampling out of total 217 villages, city Wardha was divided in 40 clusters, and all 40 clusters were considered for sampling. The selection of families was done by the method given in UNICEF model i.e., by cluster sampling.

Out of rural 948 children aged below 5 years 216 (22.78%) in the age group of 11 to 23 months, whereas in urban areas these figures were 777 and 225 (28.3%) respectively. In rural areas 44.4 per cent and in urban 43.5 per cent of the children were fully immunized, the similar figures of partial immunization in respective areas were 52.3 and 54.7 per cent and for non immunization the figures were 3.24 and 1.78 per cent. The reason quoted for non immunization were in the order: unawareness of need for immunization followed by vaccinator's absence, non availability of vaccine and business of mother for rural area. For urban area the sequence of reasons was unawareness of need, vaccinator's absence, unawareness of need to return for 2nd and 3rd dose, illness of children and non availability of vaccine, etc.

The drop out rates for DPT and OPV were high for rural areas as compared to that of urban areas.

36. FETAL GROWTH: ASSOCIATION WITH GESTATION, DIETARY INTAKE, HEAMOGLOBIN AND ANTENATAL CARE IN RURAL AREAS

N.K. TYAGI, M.S. BHARAMBE, C.M. BADOLE

M.G. Institute of Medical Sciences, Wardha.

615 mothers delivering singleton live born babies in rural areas around M.G. Institute of Medical Sciences. Sewagram, Wardha, were subjected to anthropometric, heamoglobin, dietary intake measurements. Their offsprings were weighed naked.

The mean maternal weight (MWt), height (MHt), heamoglobin (Hb), gestation (Gest), protein and calorie intake were 42.43 Kg, 149 Cm, 8.84 g/dl, 39 Wks, 37 g/day and 1657 Cal. per day, respectively.

The mean birth weight increased significantly with gestation, Hb, protein and calorie intake. However, in case of calorie intake increase was not so consistant, i.e., birth weight did not show much increase after 1500 Cal./day intake.

The proportion of low birth weight (LBW) babies was negatively associated with all the maternal parameters in the same magnitude as birth weight increased.

37. CORRELATION OF DIFFERENT FACTORS INFLUENCING BIRTH WEIGHT

M.S. KOTIAN, SANTHOSH T. SOANS, MOLLY PHILIP

K M C, Mangalore.

One of the most critical stages in the evaluation of new therapies involves the planning of comparitive clinical trials. The detection of influential observations from regression models have received the attention of many authors. (COOK 1977, CHATTERJI & HADI 1986). WHO has recommended the birth weight as one of the specific indicators of the nutritional status as well as general health status of the community. Studies on the birth weight so far have attempted to elucidate the role of various factors by studying a few isolated factors. In this study 568 consecutive live born babies were selected during October, November and December 1988 in the Lady Goschen Hospital, Mangalore of Coastal Karnataka. The different measurements like Birthweight, Midarm circumference, Chest circumference, Head circumference and gestational age were collected by standard techniques between 24 to 48 hours after birth. By applying student's 't' test, Fisher's 'F' test the data was analysed to find out the significant difference. The Zero matrix Correlation table shows the high positive Correlation of birth weight with all the anthropometric measurements viz. MAC, CC, HC and Gestational age and also the inter relationship between the different factors. Out of all these measurements MAC shows the highest Correlation ($r = 0.95$) with respect to Birth weight. The regression lines were drawn to get the birth weight from the measurements MAC, CC and HC.

38. REASONS OF DROPOUT AND SIDE-EFFECTS IN LONG TERM USERS OF ORAL PILLS: INSIGHTS FROM COMMUNITY BASED DISTRIBUTION PROJECT, VARANASI

R.N. MISHRA AND I.C. TIWARI

Banaras Hindu University, Varanasi.

The purpose of this paper is to throw light on side-effects and reasons of dropout of oral pill users. The data source of this paper was derived from Sept. 1989 – a retrospective survey of Community Based Distribution Project, Varanasi for 682 women who had used pills without any break for more than 18 months. The information on side-effects and reasons of droupout along with various demographic characteristics were collected. 320 users out of 682 were found having more than 3 living children. The reasons of dropout for these 320 users could be the best source for decision makers to run the programme successfully.

39. NUTRITIONAL STATUS AND CLINICAL SYMPTOMS OF VARIOUS DEFICIENCY DISEASES OF SCHOOL CHILDREN

D.K. GROVER AND I. GROVER

Haryana Agricultural University, Hissar.

The clinical examination is the most essential part of the nutritional survey. Malnourished and undernourished individuals show signs and symptoms due to multiple deficiencies in the diets. Some of the signs and symptoms may be common in several deficiency states. Various deficiency diseases were observed by observing hair, lips, tongue, skin and eyes. The nutritional status and measurement of growth was taken in terms of height and weight. A random sample of 100 subjects comprising 56 males and 44 females mostly in the age group of 6–7 years in a low-socio-economic group was selected. The association between height and weight with respect to hair, lips, tongue, skin, and eyes was studied by employing X^2 test. The association was significant between height and hair, height and lips, weight and tongue, height and tongue. Of the various deficiency symptoms observed, deficiency symptoms of lips and tongue were more frequent than of hair, eyes and skin which suggested that in mild to moderate malnutrition only lips and tongue are affected. No case of oedema was detected in the sample while 61 per cent had dry and rough skin and 39 per cent had normal skin.

40. EFFECT OF IMMUNIZATION PRACTICES ON SELECTED GROWTH PARAMETERS OF PRE-SCHOOL CHILDREN IN A SOCIO-ECONOMIC GROUP

D.K. GROVER AND I. GROVER

Haryana Agricultural University, Hissar.

Pre-schoolers in India constitute about 16 per cent of the total population as against 7 per cent in the technologically advanced countries. In the underdeveloped and developing countries, pre-school children in particular are victims of malnutrition and undernutrition. Our data were based on measurements of 50 male and 50 female pre-school children from low socio-economic group. The comparison of the anthropometric measures were made with standard measurement and effect of immunization on growth parameters studied. It was found that 4 per cent male children and 8 per cent female children fell below the standard height while 12 per cent of male and 8 per cent of female children were having their body weight less than the minimum. The sitting height of all the children were normal but the arm circumference of 88 per cent males and 88 per cent females was less than 16 and 15.6 cm. respectively, indicating that development of muscles was below normal. Retarded chest growth was also observed in 47 percent males and 28 per cent females. Surprisingly the percent of male children having calf circumference below the minimum was five times more than that of the female children. The mean of almost all the anthropometric measures was greater for both boys and girls for the 1–2 years and 2–3 years age groups in immunized group as compared to non-immunized group. Test of significance was performed with t-test. Correlation coefficients have also been calculated to ascertain the strength of linear relationship between different measures under study.

41. PREGNANCY AND BREAST FEEDING PRACTICES, BELIEFS AND TABOOS IN A RURAL VILLAGE OF KERALA

PADMA MOHANAN, MOLLY PHILIP

Kasturba Medical College, Mangalore.

The health of the people is one of the primary concern of any society. Good health and efficiency depend upon food habit to meet the needs of the body throughout the life span. Social customs dictate the elements of human behaviour. In India there are remarkable variations in food habits, concepts of health and hygiene. This study attempts to examine the practices, beliefs and taboos relating to pregnancy and breast feeding which are detrimental to the healthy growth of infants. The findings are drawn from the study conducted among 450 women in a village of Kerala. The population for the study consisted pre-dominently mothers having living children of preschool age namely 6–60 months. The influence of different variables like religion, education and occupation on the type of food consumed during pregnancy and the various other practices were studied. It was revealed that those mothers who were economically and educationally backward had practically no knowledge with regard to the items of food which are necessary for the proper growth and nutritional requirement of the children. By applying chi-square test statistical significance was calculated. It was found that a large majority (68.6%) of the muslim respondent avoided extra foods during pregnancy. It was specially observed that the food habits on extra food on pregnancy varied among different religious groups. Chi-square test showed that there is significant relationship between the two variables.

42. EPIDEMIOLOGICAL ANALYSIS OF RISK FACTORS RELATING TO PRECANCEROUS LESIONS OF UTERINE CERVIX — APPLICATION OF MULTIPLE LOGISTIC REGRESSION MODEL

N.S. MURTHY, L. SATYANARAYANA, SHASHI SHARMA, ATUL JUNEJA, ASHOK SEHGAL, AND USHA K. LUTHRA

Institute of Cytology and Preventive Oncology, Maulana Azad Medical College, New Delhi.

The linear logistic regression model has broadened the scope of case control study analysis as a multivariate approach. The model forms the basis for statistical and epidemiologic inference where odds ratio are of intrinsic interest and multiple risk factors are to be analysed. In this paper, a multiple logistic regression was employed to understand the independent risk factors related to precancerous lesions of uterine cervix.

Data was collected from 1107 cytologically detected dysplasia cases and 1058 matched controls on clinical parameters, socio economic variables, reproductive history, adoption of family planning practices and presence of infections. The univariate analysis revealed significant association with education of women (OR = 1.3) education of husband (OR = 1.3) religion (OR = 1.5), age at consummation of marriage before 18 years (OR = 1.5) and presence of cervical erosion (OR = 1.4) as significantly associated risk factors. The multivariate analysis helped to identify the independent risk factors as presence of cervical erosion, religion and age at consummation of marriage before 18 years.

43. GEOGRAPHIC DIFFERENCES IN CANCER INCIDENCE BY SEX AT VARIOUS SITES IN CITY WARDS IN GREATER BOMBAY

B.B. YEOLE

Bombay Cancer Registry, Bombay.

In this paper an attempt has been made to study the geographic variations in cancer incidence at various sites, by sex, in Greater Bombay. Crude incidence rates for each site in each ward have been calculated, utilising the data collected by the Bombay Cancer Registry, for the years 1979 to 1984. The variations between the highest and lowest crude incidence rates in the different wards and the ratio of the highest to the lowest rates for each primary site, were calculated.

Detailed analyses show that there is a positive relationship between male and female rates for certain sites such as the Buccal Mucosa, Oesophagus, Stomach, Colon, Rectum and Liver. The Tongue, Oropharynx, Hypopharynx, Lung and Larynx present rates which vary widely in males but only slightly in females. Certain cancers such as of the Pancreas, Hodgkin's Disease, Lymphoma and Leukaemias do not present any particular pattern. It was interesting to find that these sites where environmental factors may be of etiological value such as excessive tobacco chewing and smoking, tend to fall in the second category. Particularly striking is the finding that habits of etiological value are those to which men are more frequently addicted than women, probably explaining the low rates in females and the wide variation in male rates.

44. APPLICATION OF COX MODEL FOR PROSPECTIVE FOLLOW UP STUDY DATA ON UTERINE CERVICAL DYSPLASIA

ATUL JUNEJA, N.S. MURTHY, SHASHI SHARMA, A. SEHGAL, K.C. SHARMA AND USHA K. LUTHRA

Institute of Cytology and Preventive Oncology (ICMR), New Delhi.

The survival analysis for the follow up study data has been of great help to estimate the survival experience of the subjects. Kaplan Meir estimate provides an accurate analysis on precise survival time rather than conventional life table analysis which is based on grouped data. Cox Proportional hazard model is used to study the survival trends using multivariate approach where time to response is influenced by other measured variables known as prognostic factors or covariates, which normally represent either inherent difference among the study subjects (age sex etc.) or constitute a set of one or more indicator variable. The covariates may also describe changes in patients prognostic status as a function of time. The technique presumes death rate (we shall be discussing rate of progression to malignancy or dysplasia) may be modeled as log linear function of covariates. The cox model is mathematically defined as

Use of Cox model has been demonstrated in long term prospective study conducted at ICPO on uterine cervical dysplasia which aims to find out risk factors related to development of precancerous and cancerous lesions. This long term study registered more than 1100 dysplasias and equal number of controls during 12 years period.

45. A PROSPECTIVE COHORT STUDY ON UTERINE CERVICAL DYSPLASIA — ASPECTS OF STUDY DESIGN AND FOLLOW UP RESPONSE

L. SATYANARAYANA, N.S. MURTHY, ASHOK SEHGAL & U.K. LUTHRA

ICPO, New Delhi.

To elucidate possible preventable risk factors in the process of cervical carcinogenesis with an aim towards evolving feasible strategies for control of cancer of uterine cervix, a multidisciplinary

01821
R(ME)
COMMUNITY HEALTH CELL
326, V Main, I Block
Koramangala
Bangalore-560034

prospective cohort study is being carried out at ICPO. This paper describes the study design of the multidisciplinary approach of the cohort study. Cohort in the present study includes a group of women found to be with precancer and early cancer after cytological screening of 1,00,000 women attending gynaecological OPDs, as large numbers are usually required in cohort studies because of low incidence rates of the outcome variable. Loss of cases in the follow up during the study is an important problem. This paper further enumerates some of the problems experienced in the follow up response study subjects.

46. A UNIQUE COHORT: POPULATION EXPOSED TO TOXIC GAS AT BHOPAL

KAMBO INDRA P.

Indian Council of Medical Research, New Delhi.

In epidemiology cohort studies constitute a major part as analytical designed studies. In such studies a group of people having in common an exposure to some event which can be a causative factor for adverse outcome, are observed over a period of time.

Cohort studies enable us to establish temporal association between exposure and its effect. It also allows us to study multiple effects of a single exposure with minimum selection bias.

Cohort studies generally are labelled as prospective and considered more expensive and time consuming as compared to case control (retrospective) studies. In fact words prospective and retrospective in cohort studies are used to describe occurence of events depending upon the temporal relationship.

The Bhopal disaster of toxic gas leak from Union Carbide on 2nd/3rd December 1984 provided to the researcher a very special type of closed cohort for observation over a long period of time. One of the vulnerable groups was females of reproductive age group, which included pregnant women, women exposed to risk of pregnancy and unmarried women who may subsequently be at risk of pregnancy.

Pregnant women (2566), who were in different stages of pregnancy at the time of gas leak were followed for outcome of pregnancy in terms of spontaneous abortion, still birth, congenital malformation etc. Women with pregnancy below 20 weeks of gestation were considered as at risk of abortion. The abortion rate so obtained could not be compared with scarcely available population based abortion rates. A comparable cohort (1218 women) taking 3rd December 1985 as day for registration was studied for outcome of pregnancy. The abortion rate in the exposed population (24.2%) was significantly higher than in control population (5.6%).

Subsequently to study the effect of exposure to gas on reproductive functions, an exposed cohort from severely affected area and a control cohort of m rried females in the age group of 15–45 years and at risk of pregnancy were studied in retrospective manner in 1988/1989. Thus giving us a minimum observation period of about $3\frac{1}{2}$ years . These cohorts were compared for time taken for next conception and outcome of subsequent pregnancies etc. following exposure to gas Percentage of women conceiving in any fixed period of time in fact was on a higher side in exposed population than in control population. Abortion rates were also on the slightly higher side in exposed population. However this study does not provide any evidence of diminished capability to reproduce.

47. APPLICATION OF LOG LINEAR REGRESSION MODEL TO ESTIMATE THE RELATIVE RISK OF PROGRESSION TO CERVICAL CANCER FROM DIFFERENT GRADES OF DYSPLASIA

N.S. MURTHY, S.S. AGARWAL, SHASHI SHARMA,
SARITA SARDANA, ASHOK SEHGAL AND USHA K. LUTHRA

Maulana Azad Medical College, New Delhi.

A total of 1107 women who were identified by cervical smear to have varying degrees of cervical dysplasias were followed up longitudinally for a period ranging from 15 to 136 months to understand the natural history of precancerous and early cancerous lesions of the uterine cervix. During the follow up, 68 women progressed to malignancy from different grades of dysplasia.

The present communication besides reporting probability for progression to cervical cancer (carcinoma in situ) (PPcx) among initially mild. moderate and severe grades of dysplasia cases at different follow up periods and also estimates the relative risk for development of Cervical cancer (RRcx) among different grades of dysplasia.

The probability for development of cancer was estimated using survival method of analysis suggested by Kaplan and Meir.

A log linear regression model was fitted. The findings revealed that the probability for progression to malignancy at the end of 108 months of follow up were 4.2%, 29.4% and 45.2% respectively. The estimated values of RRcx revealed approximately 8 and 25 fold greater risk for initially moderate and severe dysplasia cases in comparison to mild category.

48. STATISTICAL ANALYSIS OF COMPUTERISED TOMOGRAPHIC SCAN VALUES

S. GOVINDARAJU, K. GANAPATHY AND T.R. NARAYANAN

Madras Christian College, Madras and Madras Medical College, Madras.

Brain is the most sensitive part of the human body. Brain tumour seems to be a common lesion among people in recent years. A number of studies are being carried out all over the world

to find out causes of brain tumour and methods to control them. Computerised Tomographic (CT) Scan machines are widely used to identify the location and size of the tumours. Neurologists classify brain tumours into different categories such as Meningioma, Glioma, Schwanoma, Secondaries, Pituarity, and Tubercloma etc. Neuro-surgeons are doing their best to identify the category of tumour from CT images. At times, they misclassify one tumour as another category since there is no unique procedure available to classify a particular lesion. Exact nature of the tumour is ascertained only after the patient is operated upon. A brain surgery involves considerable amount of money, precious time of expert doctors and in some cases loss of psychological balance in patients. It also happens that a patient whose survival chances are very minimal or almost nil in many cases, is operated due to wrong classification of the brain tumour. Is it possible to find out the exact type of tumour before the operation? This question led us to carry out a detailed study of brain tumours. Eighty-eight histologically verified cases are taken up for analysis. Plain CT values are obtained for all of them. CONORAY 280 injection is administered to each one of them. CT scanning is done after 10 minutes, 60 minutes, 3 hours and after 24 hours for each of the injected patients. All the patients are operated and the tumours of them are correctly identified after the operation.

On the basis of the CT values of these patients, we have used multivariate methods to formulate a criterion to determine the type of tumour. Identification of tumour by the surgeon can be used to verify the accuracy of the statistical results. Homogenity tests for variance-covariance matrices, equality of mean vectors and discriminant functions are some of the techniques used for the present study. It is possible to differentiate various types of tumour using discriminant functions. An attempt is made to find out the exact time points at which CT values should be taken to provide valuable information to differentiate various groups. Preliminary results are promising. The work reported here is a part of a project in progress.

49. IMPACT OF AGROECONOMIC, SOCIODEMOGRAPHIC AND ENVIRONMENTAL HEALTH INDICATORS ON THE NUTRITIONAL STATUS OF PRE-SCHOOL CHILDREN — A CASE STUDY

D. KRISHNA, K. VISWESWARA RAO, P. J. REDDY

Indian Institute of Chemical Technology, Hyderabad.

Investigations have been carried out to study the influence of socio-economic indicators on malnutrition among pre-school children. Data has been collected from two blocks viz. Rajendernagar and Medchal blocks of Ranga Reddy District, A.P., consisting of fifteen villages each. Detailed questionnaires were raised and data has been collected in four schedules viz. household composition and demography; socio-economic record; housing conditions; environmental sanitation and personal hygiene awareness to nutrition, health, family planning, child rearing practices and other developmental programmes. Each questionnaire consists of about 100 questions. Subjects selected for study were from backward communities of villages around Rajendernagar and Medchal. Corrrelations were studied among anthropometric variables reflecting long term and short duration forms of malnutrition and agroeconomic, sociodemographic and environmental health indicators.

Various types of multivariate statistical techniques like multiple linear regression analysis, stepwise discriminant function analysis, principal component analysis and factor analysis were utilised to trace (i) the best set of indicators of malnutrition and (ii) the best set of socioeconomic indicators associated with various forms of malnutrition.

The results indicated that (i) Height (%) with Weight for Height (%) or Weight/Height^2 was the best set reflective of various forms of malnutrition (ii) Weight for Height (%) and Weight/Height^2 were well correlated and the correlation coefficient is close to 0.99. (iii) Percapita income, family size, age of the child and land in possession were found closely correlated with forms of malnutrition. Classifications using best set of agroeconomic, sociodemographic and health indicators were framed and their relative merits assessed in comparison with those available in literature. The results will be presented and discussed.

50. DEMOGRAPHIC ASPECTS OF PULMONARY TUBERCULOSIS IN DISTRICT WARDHA, MAHARASHTRA

N.K. TYAGI, P. NARANG, S. NAYAR AND GIRIBALA KSHIRSAGAR

M.G. Institute of Medical Sciences, Wardha.

A house to house survey to detect symptomatics for tuberculosis during February 16th, 82 to April 30th, 1988 was undertaken. Considering the nature of the disease, for effective containment a contiguous population of 7,73,493 with sex ratio 108 was surveyed.

All symptomatics were subjected to sputum examination (smear and culture). The subjects positive for smear/culture were considered for the prevalence of pulmonary tuberculosis in the present study.

The overall prevalence of tuberculosis was 2.06 per 1000 population, in urban and rural areas 1.78 and 2.18 respectively. Among males and females the prevalence was 2.63 and 1.45 per 1000 population respectively. The prevalence among males was consistently higher as compared to females in both urban and rural areas. The prevalence increased with age consistently among males whereas, in females increase was only upto 55 years in urban areas and 50 years in rural areas. In lower age groups also the prevalence was lower in females as compared to males.

These age and sexwise differences depict the entire gamut of socio-economic and cultural make-up of the society in the area. Hence, in the present study an attempt has been made to reason out these differences.

51. INFLUENCE OF CHILDHOOD MALNUTRITION ON AGE AT MENARCHE IN S. INDIAN GIRLS

M. LAKSHMAN, M. PADMAVATHY AND P.S.S. RAO

Christian Medical College, Vellore.

A cohort of 599 rural and 615 urban girls aged 5 & 6 years was prospectively followed up for physical growth and sexual development since 1982. Data on age at menarche of these girls have been examined for possible effects of urbanization and childhood undernutrition. Girls with urban background have a lower mean (SD) menarcheal age of 12.96 (0.96) as compared to 13.29 (0.94) for their rural counterparts, the difference being statistically significant ($p < 0.05$). The urban girls who were normal attained menarche at the mean age of 12.4 compared to 12.8 and 13.4 respectively for those with mild and moderate grades of malnutrition during childhood. The mean menarcheal ages for rural girls of similar groups are 12.8, 13.4 and 13.5 respectively. The phenomenon of attaining critical body weight and body size before the onset of menarche has been examined in these girls and the results are discussed in the light of the existing literature.

52. MULTIVARIATE ANALYSIS OF PSYCHOLOGICAL CHARACTERISTICS OF EPILEPTIC PATIENTS

S. GOVINDARAJU, M. BAGAVANDAS

M. SABIHA SULTANA AND B. VIRUDHAGIRINATHAN

Madras Christian College, Madras and Madras Medical College, Madras

Epilepsy is a common disease prevalent among the people in India. Neurologists view that epilepsy is a complex system caused by a variety of pathologic processes in the brain and this results in the abnormal behaviour of epileptics. The nervous system gets affected and very often the epileptics are prone to psychological and social imbalances. Psychological expressions such as anger, fear, loss of memory etc., of epileptics are generally non-normal.

An attempt has been made to study the psychological behaviour of epileptics treated at the Government General Hospital, Madras. Epileptics coming for treatment were divided randomly into two groups. Psychological tests to measure their memory, intelligence, anger expressions and adjustments with other people were given initially to epileptics of the two groups. One group consisting of 85 patients were given drugs as well as psychological treatment (experimental group) and another group comprising 50 patients were given only drugs (control group) to control epilepsy. Psychological tests were repeated for the two groups after giving treatment for six months and after one year.

Psychological characteristics observed initially, after six months and after one year on the epileptics of the two groups were subjected to rigorous statistical analysis. Multivariate tests indicate that the experimental group which was given both medicines and psychological treatment recovered faster than the control group. It has also been found that the rate of recovery of this group is significant during the first six months. The factors which influence the psychological behaviour of epileptics are also studied in detail.

53. ANTHROPOMETRIC SURVEY OF TAMILNADU POPULATION AGED 15 TO 20 YEARS

K N. SUBRAMANYAM AND P.S.S. RAO

Christian Medical College, Vellore.

Normal growth and development is directly related to physical, mental and social appreciations. Most of the studies are surveys on cross sections of populations drawn from all socio-economic groups and relates to Nutritional status or Anthropometry. It has long been recognised that children from third world countries tend to be smaller and lighetr than those drawn from developed countries. Weight for height standards in children are usually constructed on the basis that the expected weight for a given height does not depend on age, an assumption which is unjustified. (COLE T.J.: 1979). Based on the above Theory the results of a cross sectional anthrompoetric survey for 16–20 year old Tamil Nadu Children assessed using multiple regression analysis. Height, weight, MAC, CC, BaD, BcD, sitting height vertex and Blood Pressure were measured in all 897 children comprising from both rural and urban areas in southeastern Tamilnadu. The findings reveal that the children were found to be shorter and lighter as per the standards of Martin and Saller.

The present paper investigates standards of age-standardized weight for age-standardized height, the standardization being achieved by expressing weight and height as fractions of the 50th centile for age from a suitable growth standard. Body mass Index, pondoral Index and F. Index were selected and analysed because they reflect body size (leanness to stoutness) and body mass (under weight to over weight). The above indices provide continuous quantitative scales, fecilitate group comparisons and enable investigators to study large numbers of subjects.

54. GROSS MOTOR INDICATORS OF PSYCHOSOCIAL DEVELOPMENT OF CHILDREN

K.K. KAUL, B. KURUVILLA

Government Medical College, Jabalpur.

Some skills are found in every culture and there is a need for devising culture appropriate indicators of psychosocial development. It is the prime responsibility of physicians, educators public health and social service workers to see that the child is given the best opportunity to carry ou, the privilege of helping the child to develop his full potential of physical, mental and social growthe In the research, an effort was made to develop a reliable technology for early identification of developmental milestones in the age of 0–6 years in the community for planning early intervention strategies- In other words, to devise a process leading to the establishment of locally relevant screening test. based on growth & psychosocial development of children. A cross – sectional study was done on 3011 tribal children and 3219 urban slum children. Bijadandi block in Mandala district (M.P.) and Jabalpur city served as the tribal and urban areas respectively and all children aged 0–6 years in these areas were enrolled for the study.

The age percentiles in months for each gross motor developmental milestones were estimated for both tribal and urban children. Urban children attained a significant proportion of milestones at an earlier age compared to tribal children. It was found that there is no sex difference in the age percentiles. The centile curves were also made. There was no significant difference between normal children and below normal children in their age of attaining different developmental milestones.

55. EFFECT OF SOCIO-ECONOMIC VARIABLES ON CONSANGUINITY AMONG THREE ENDOGAMOUS GROUPS OF CHITTOOR DISTRICT, A.P.

A. CHANDRASEKAR

Christian Medical College, Vellore.

This paper examines the relationship between consanguinity with that of socio-economic variables such as Family type, Family income, Education of husband and wife and Marital distance among three castes of Chittoor District, which occupy different strata in the social stratification. Stepwise multiple regression analysis was employed for this purpose. The final results show that only martial distance has significant ($P < 0.05$) negative correlation with inbreeding coefficient in the each caste and in the entire population. While the scheduled caste family type also shows significant ($P < 0.05$) positive correlation.

56. PERSONALITY ADJUSTMENT OF SCHOOL GOING ADOLESCENTS IN VELLORE REGION

E. JOSEPH ALEXANDER AND P.S.S. RAO

Christian Medical College, Vellore.

The paper reports an investigation into the personality adjustment of adolescents from two neighbouring and culturally similar groups in Vellore region of Tamil Nadu. The difference in their adjustment was analyzed based on their parent's education, parent's income, sex, birth order, and number of live births in the family. The subjects were selected from one of the longitudinal studies of the department of Biostatistics, Christian Medical College, on 616 rural and 599 urban adolescent so They were equated as nearly as possible for age, schooling and nutritional level and then 81 rural and 76 urban students were randomly selected for this study. To measure the personality adjustment, Roger's Personality Inventory was administered individually to the students. The inventory was revalidated and high score indicates poor adjustment. The obtained F – and t – ratios indicate that birth order, number of live births in the family, parent's income and father's education do not influence the adolescents' adjustment. Mother's education has a significant effect on urban students' adjustment but no effect on rural students' adjustment. Male and rural students are better adjusted than female and urban students. The data were subjected to multivariate analyses and the findings reported.

57. BODY MASS INDEX IN SCHOOL AGE CHILDREN AND ADOLESCENTS

N. BALAKRISHNA, B.V.S. THIMMAYAMMA AND
K. VISWESWARA RAO

National Institute of Nutrition (ICMR), Hyderabad.

The index weight/height^2 which has been known as the body mass index has been found useful for the assessment of the current or short duration forms of malnutrition among infants, toddlers and adults. It was found closely correlated with growth rates of infants and toddlers. Children with consistently lower levels of body mass index were observed with retarded growth status and onset of clinical signs of protein energy malnutrition, vitamin A deficiency and severe forms of anaemia (NIN studies, 1968, 1974, 1979, 1986, 1988). Studies of Dr. Chuttani and Dr. Venkata Rao in children of 5–10 years age have shown that body mass index was independent of age. Studies on school age children and adolescents (5–18 years) have been very few. A study has been undertaken with the data available on 5–18 year age group children of varied socio-economic status surveyed in rural and urban areas of Hyderabad city to assess whether the body mass index is good for the assessment of the nutritional status of school age children and adolescents. Its efficacy in comparison with other indices–weight/height and weight/height^3 and weight for height (%) was assessed through comparison of correlations with height, weight and other anthropometric measurements. Body mass index and weight for height (%) are found best for use. Effect of socio-economic status and sex differentials on variatiions in the body mass index and weight for height (%) was assessed. The results will be presented and discussed.

58. TEACHING BIOSTATISTICS TO UNDER GRADUATE MEDICAL STUDENTS - THE P.S.G. MODEL AND SOME RECOMMENDATIONS

C. ANIL MATHEW, V. THOMAS CHACKO AND R. GOPALAKRISHNAN

PSG Institute of Medical Sciences and Research, Coimbatore.

Department of Community Medicine starts taking classes in Community Medicine from the first year MBBS onwards. Special features of our training programme include integrated teaching in the form of theory and practicals, field work, group discussion, journal review, record writing and exposure to the uses of computers in medical field. The scheme of our training programme in statistics is discussed in this paper as also some recommendations for improvement.

59. TEACHING OF STATISTICS IN MEDICAL COLLEGES

N.G.K. NAIR

Institute for Research in Medical Statistics, Madras.

The use of statistical methodology in medical research is often not fully appreciated among medical professionals in India, to the extent it is understood and utilised by their counterparts in Western countries. This is mainly because the emphasis in the teaching of statistics is on how to compute various test statistics rather than on when and why. The thrust of the teaching is on the algebraic expressions for which most non-mathematically minded medical people have an allergy, and little is said by way of real-life applications. In order to create a better awareness of the use and scope of statistical methods, the teaching of statistics should undergo a thorough change, minimising the computational aspects, at least in the early stages. With the proliferation of personal computers and availability of software packages, the calculation part becomes the least important. But packages or computers cannot tell us which is the appropriate statistical test to use relevant to the study design and type of data. However, more important than the choice of the appropriate statistical test is the basic understanding of concepts of Significance test, Confidence Interval, Type I error, Power, and interpretation of Significance tests, Correlation coefficients etc. This paper attempts to elucidate these points with examples drawn from the fields of medicine/public health.

60. SELF ASSESSMENT OF TEACHING SKILLS TO IMPROVE TEACHING BIOSTATISTICS

G.S. SAIPRASAD AND B.M. AIYANNA

Armed Forces Medical College, Pune.

A batch of 78 undergraduate medical students attending biostatistics teaching sessions were administered a questionnaire for self-assessment of teaching, using W.H.O. methodology, with the objective of improving teaching biostatistics. The topics covered in the survey were introduction to biostatistics, types of data and presentation of data. Students were asked to grade the teacher for a set of nineteen teaching skills as 'very skillful', 'satisfactory', 'poor', 'not observed at all' and 'cannot say'. The topic comprehension was to be graded as 'understood well', 'understood with exceptions', 'confused', 'did not understand' and 'cannot say'. An open ended question enabled students to liberally express their views. Students did not have to reveal their identity.

It was observed that for some teaching skills such as, 'Explains clearly', 'provides examples', 'relates issues to real world' etc., the percentage of students grading the teacher either as 'very skillful' or 'satisfactory' varied from 53.8 per cent to 79.4 percent. For some other skills such as, 'can inspire and motivate', 'arouse interest/curiosity', 'provide stimulating materials' etc., the teacher was graded either as 'poor' or 'not observed at all' by 50 percent to 65.4 percent of students.

The percentage of students, grading the comprehension of a topic either as 'Understood well' or 'Understood with exceptions' ranged from 59 percent for the topic 'Scales of measurement' to 97.2 percent for 'Line diagram'. The percentage of students grading either as 'confused' or 'did not understand' ranged from 5.2 percent for 'line diagram' to 30.8 percent for 'scales of measurement'. The students' overall reaction to the teaching sessions was graded as either 'enthusiastic' or 'positive' by 52.6 percent, as either 'very negative' or 'somewhat negative' by 20 per cent of students and 20.5 per cent of students did not answer. The open ended comments column revealed some interesting and useful features. The students' views on teaching skills and subject comprehension are useful to modify and improve teaching.

61. USE OF COMPUTER-ASSISTED LEARNING AND OTHER SELF-LEARNING MATERIAL IN TEACHING RESEARCH METHODS AND MEDICAL STATISTICS TO MEDICAL RESEARCHERS

G.S. SAIPRASAD, A.G. GOKARN AND B.M. AIYANNA

Armed Forces Medical College, Pune.

Epidemiologic research methods and medical statistics are not given emphasis during post-graduate medical education. Whatever little teaching that exists is mostly teacher-centred. Doctors reach specialist status without adequate exposure to these topics. During career they find themselves illequipped to infer from medical journals, as well as to plan and conduct research. They are not in a receptive mood to undergo a concentrated training course on research methodology. However, they are keen to learn about those topics which are required for a particular project or have come across in a medical journal. Lack of access to simple material on these topics is a hurdle for those interested in learning. The concept of self-learning which has a learner-centred approach is needed in medical education. Computer-assisted learning is a method which can be used for self learning.

A programme to facilitate self-learning is being planned. Standard training material on essential topics will be prepared, which can be easily accessible from a central place by photocopying. Computer-assisted learning packages will be prepared. While deciding on the topics to be covered and their content, opinion of experts in different disciplines as well as the opinion of consumers will be considered. Volunteer faculty members and postgraduate students will be randomized into two groups for evaluating the computer-assisted learning packages for each topic. One group will be given only standard text references material and the prepared reading material. The other group will be given the prepared reading materials and the computer assisted learning modules. Both groups will be assessed by scoring before and after the learning programme by independent faculty members.

MP-100
1821

62. CONTRIBUTION OF AGE AT MARRIAGE AND FAMILY PLANNING TO REDUCTION IN FERTILITY

J. RICHARD AND P.S.S. RAO
Christian Medical College, Vellore.

The relationship between age at marriage and family planning adoption and their contribution to fertility were investigated using data collected from a population of 35,000 in Vellore Town and 45,000 in K. V. Kuppam Block, an adjoining rural area. Trained female interviewers visited the households in these areas and gathered demographic data of the households and reproductive performance data including adoption of family planning of the married women.

The results indicated that there was no clear association between age at marriage and acceptance of permanent methods of family planning. This suggested that family planning was adopted after begetting a fixed number of children, whatever might be their age at marriage. In order to examine the relative influence of age at marriage and family planning acceptance of fertility, analysis of variance and multiple classification analysis were done. In these analyses, age at marriage and family planning adoption were taken as main effects and current age of women was considered as covariate. It was found that even after adjusting for family planning adoption and current age, those who married early had more number of children compared to those who married late. There was a good gradation of number of children ever born over age at marriage. The level of beta coefficients which gave an indication of relative contribution of the variables was higher for age at marriage than for family planning adoption. So the contribution of family planning on the number of children ever born is lower than that of age at marriage. This is true in both the rural and urban areas. Therefore increase of age at marriage should be advocated more vigorously for faster reduction in fertility.

63. DETERMINANTS OF CLOSED BIRTH INTERVALS

B. KURUVILLA, J. RICHARD, AND P.S.S. RAO
Christian Medical College, Vellore.

One of the important, if not the most important determinants of a complete family formation is Birth Interval. Short birth intervals affects the morbidity and mortality of both mother and child. In this retrospective study it was attempted to study the social, biological, demographic effects on closed birth interval – the space between two consecutive live/still births. The length of the birth intervals were also estimated. A sample of 1313 rural and 1064 urban legally married women were surveyed from the North Arcot district, Tamil Nadu, by stratified systematic sampling procedure. These women contributed 2879 births in rural areas and 4290 births in urban areas for this study. The length of closed birth interval was estimated at 31 months in rural and 30 months in urban, the difference was not statistically significant. A positive association was observed between closed birth interval and the age of women at interview, age at termination ($P<0.001$) and a negative association with age at marriage ($P<0.001$). The multiple regression analysis also showed nine significant variables, age at termination, age at marriage, parity, breast feeding, previous birth interval, number of males in the family & number born in the previous termination. These factors accounted for 32.34% of the variation in the rural and 32.17% in urban and was significant at $P<0.05$. None of the social factors were seen to be significantly associated which were confirmed by employing both bivariate and multivariate statistical techniques.

64. SEASONALITY OF CONTRACEPTIVE ACCEPTANCE AND DISCONTINUATION IN MATLAB, RURAL BANGLADESH

A. I. CHOWDHURY, K.M.A. AZIZ, AND V. FAUVEAU

ICDDR, Bangladesh.

The hypothesis that the contraceptive use prevalence has a higher acceptance in the winter season and higher discontinuation in the rainy season was tested in Matlab, a rural area of Bangladesh. The data on contraceptive use came from the service statistics of Matlab Maternal Child Health and Family Planning (MCH–FP) introduced in 1977 by the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR, B). We have plotted the time trend of contraceptive acceptance and discontinuation rates by three seasons of the year (Cool, Dry and Rainy).

Results indicated that cool season is the peak timing of contraceptive acceptance and rainy season is the peak timing of contraceptive discontinuation.

65. ESTIMATION OF CURRENT FECUNDABILITY AND CHILD MORTALITY FROM THE DATA ON OPEN BIRTH INTERVAL

K. B. PATHAK, A. PANDEY AND U. S. MISHRA

International Institute for Population Science, Bombay.

A steady state probability distribution of open birth interval has been derived with a provision of the survival status of the last child. In deriving the said distribution, we consider the survivorship risks at childhood ages to follow a Weibull function. Having obtained a truncated version of the distribution of open birth interval, we apply the model to a set of data which has been generated from the data on the current levels of fertility and child mortality in India 1981, available in census reports. A logical extension of the procedure of minimum chi-square is also discussed while estimating the parameters of the proposed model.

66. FERTILITY IN KOL TRIBE OF MADHYA PRADESH

G. D. PANDEY

Regional Medical Research Centre for Tribals (ICMR), Jabalpur.

The study is based on 919 tribal eligible couples consisting of 442 Kol eligible couples of Satna district of Madhya Pradesh. It is observed that Kols differ significantly from other tribes of the area

in literacy, occupation and income. Only 9 percent Kols are literate, 74 percent work as labour and 85 percent live below the poverty line. It is observed that only 3 percent population are found surviving above the age 60 years and 44 percent in the age group 0–15.

It was found that fertility among the Kols is lower as compared to the fertility among other tribes of the same area i.e. Gonds, Mawasi and Khairwar. The total fertility rate was 4.6 births while it was 5.6 for other tribes. The parity progression ratios show prevalence of higher secondary sterility among the Kols particularly beyond the parity three. Causes of lower fecundability among the Kol tribe are need to be investigated.

67. THE INFLUENCE OF SOCIO-BIOLOGICAL FACTORS ON PERINATAL MORTALITY IN A RURAL AREA OF BANGLADESH

GOLAM MOSTAFA, VINCENT FAUVEAU, BOGDAN WOJTYNIAK AND ANDREW FOSTER

International Centre for Diarrhoeal Disease Research, Bangladesh.

This study investigates the associations between sociodemographic factors and the risk of perinatal mortality in a rural area of Bangladesh. Demographic information on all pregnancies that ended during the study period, 1982–1984, was obtained from the demographic surveillance system maintained by the International Centre for Diarrhoeal Disease Research, Bangladesh. Information on education of mothers, and education and occupation of fathers was obtained from the census conducted in this area in 1982. During the study period, 22,122 pregnancy outcomes were recorded which resulted in 21,337 live births and 785 stillbirths. There were 817 early neonatal deaths. Univariate analysis revealed that the risks of perinatal mortality were significantly associated with a maternal age less than 18 and more than 35 years, absence of prior parity and parity 5 or more, previous fetal wastage and interval between the previous and index pregnancy shorter than 24 m and longer than 60 months. The perinatal mortality rate for births to women with two or more previous fetal wastages was almost three times as high as that of women with no previous fetal wastage. Multivariate analysis confirmed the results of the univariate approach, identifying a history of previous fetal wastage, parity one, and an interpregnancy interval that was either shorter than 24 m or longer than 60 m as significant risk factors for perinatal mortality. In the context of rural Bangladesh, socioeconomic factors, as measured by parental education and father's occupation, were not found to be significant correlates of perinatal mortality.

68. BIRTH INTERVAL AND INFANT AND CHILD MORTALITY, IS AGE AT DEATH OF THE PREVIOUS CHILD IMPORTANT?

NURUL ALAM AND LOKKY WAI

International Centre for Diarrhoeal Disease Research, Bangladesh.

This study examined the hypotheses that the relationship between birth interval and infant and child mortality is confounded by intrafamilial risks of neonatal and post-neonatal deaths and that these risks of deaths as indicated by age at death of the previous child are not affected by the short birth interval. Mortality experiences of 3714 second and higher order singleton live births during

1983–84 in villages of Teknaf, Bangladesh, were analysed for previous birth interval, age at death of the previous child, mother's age and household socioeconomic status. Multiple logistic regression analysis of death/survival of children in different age groups revealed a repeated pattern of neonatal and post-neonatal deaths. Not neonatal but post-neonatal mortality of children was significantly higher for short birth interval (<15 months), particularly when the immediate previous sibling survived the post-neonatal period. Child mortality in age 1–2 years was also higher when following pregnancy interval alone or in combination with previous birth interval was short. The findings are consistent with the hypothesis that neonatal mortality is due largely to intrinsic maternal risks determined by previous child neonatal death while post-neonatal and child mortality is associated with unfavourable effect of mothers' pace of child bearing.

69. ANALYSIS OF FERTILITY DIFFERENTIALS: A PATH ANALYSIS APPROACH

Y. L. ARORA AND PADAM SINGH

ICMR, New Delhi.

Path analysis has been applied to assess the explanatory power of determinants in causing differentials of fertility. Path Analysis is actually a modified form of multiple regression analysis. Path coefficients are standardized regression coefficients. Direct, indirect, joint effects and coefficient of determination have been studied and interpreted for various levels of areal units such as states and districts. Six variables have been considered for this study and this includes crude birth rate, child mortality rate, couples protected due to sterilisation, IUD, other methods, literacy, women married and some measures of development. Data on these six variables have been used for analysis of fertility differentials for twenty two states and 351 districts. Weighted path analysis has also been applied to assess the relative explanatory power of the above variables in causing fertility differentials. Relative explanatory power changes but however both proximate and socio-economic determinants are important in causing fertility differentials.

70. LEVELS, TRENDS AND DETERMINANTS OF INFANT AND CHILD MORTALITY IN TAMIL NADU

K. NAVANEETHAM & S. IRUDHAYA RAJAN

Centre for Development Studies, Trivandrum.

In this paper an attempt has been made to study the trends and levels of infant and child mortality using estimates from various sources (Census, SRS and NSS). Also, this papertries to explain the factors responsible for the variation of child mortality in Tamil Nadu using the estimates from 1981 census data. Standardisation technique and multivariate analysis will be used in order to find out the determinants of child mortality in Tamil Nadu.

71. A STUDY OF DEMOGRAPHIC TRANSITION AMONG THE TRIBAL DISTRICTS OF MADHYA PRADESH

G.D. PANDEY, A. VERMA, AND A. GOEL

Regional Medical Research Centre (ICMR), Jabalpur.

An analysis of census data (1961, 1971 and 1981) for the five tribal districts of Madhya Pradesh (concentration of tribal population more than 50 percent of district population) has been carried out. Various population indices have been computed.

The study shows that over the two decades, 1961–81, the population composition of these districts has changed considerably. The percent child population (0–14) is decreasing and the percent aged population has shown increasing trend. The sex ratio in all the districts is higher and has shown increasing trend. In most of the districts, the sex ratio is around 1000. Decadal comparison of the various indices has shown that during the 1961–71 period, the process of demographic transition was slower, but during 1971–81, there has been rapid change.

Compared to the demographic indices for non-tribal districts, Madhya Pradesh State and India, the populations of these districts are "Young" showing higher level of fertility and mortality. Projections have been made to estimate the number of years, the tribal districts will take to achieve similar demographic characteristics as of non-tribal districts and as of the State of Madhya Pradesh.

72. AN INDIRECT METHOD TO ESTIMATE MATERNAL MORTALITY: A PROPOSAL AND FIRST APPROXIMATION

K. DEVARAJ, P.M. KULKARNI AND S. KRISHNAMOORTHY

Bharathiyar University, Coimbatore..

Though maternal mortality is known to be very high in most of the developing countries, reliable estimates of the measures are generally not available due to paucity of relevant data. This paper examines a new approach to obtain an indirect estimate of the maternal mortality ratio. Based on available data for a large number of countries, an empirical relationship between the infant mortality rate and the maternal mortality ratio was established. The relationship was found to be satisfactorily strong as could be expected since a number of common factors influence both infant and maternal mortality. The regression equation of maternal mortality ratio on infant mortality may be used as a first approximation since the data on which this is based are not necessarily of good quality. Refinements could be possible when better data become available.

73. APPLICATION OF AUTOCORRELATION IN MIGRATION OF NORTH ARCOT DISTRICT

V.P. NATARAJAN AND K.G. SELVARAJ

Christian Medical College, Vellore.

Autocorrelation of time series analysis was applied and seasonal variations were studied for the 42 months, observations regarding migration. Migration details of household and individual movements were collected during a four year period (1970 – 1973) through a prospective followup as a part of Longitudinal Studies in Human Reproduction. The study population comprised a representative segment of rural (40,000) and urban (30,000) in North Arcot District, Tamil Nadu. Inmigration and outmigration in rural and urban areas were subject to the time series analysis.

For the above mentioned data set, the autocorrelations for 16 lags were obtained. Among inmigration the number of autocorrelation coefficients which lay outside the confidence intervals (–0.33, 0.28) were none in rural and two in urban. Similarly, in outmigration the number of autocorrelation coefficients which lay outside the confidence intervals were one in rural and four in urban. The correlogram and related time series methods were interpreted through illustrations.

74. A MULTIPLICATIVE INDEX OF MODERNISM FOR DECISION MAKING

J. RICHARD AND P.S.S. RAO

Christian Medical College, Vellore.

There is a consensus that societies in India are in various stages of transition from traditionalism to modernism although the definition of modernism varies. In the context of age at marriage, the familes that arranges marriages early may be considered nearer to traditionalism and the families that approves late marriages nearer to modernism. Again, in a traditional society the timing of marriage is not decided by the bride and the groom, it involves relatives of many generations.

To quantify how traditional or how modern a decision on age at marriage is, a multiplicative index is proposed. This index takes into account the number of persons involved in the decision making on age at marriage and their relationship to the bride. The index takes the value one when it is modern and approaches zero towards traditionalism. This index is described using the data on marriage decision makers collected by the social scientists through indepth study method. (The indepth study is like participant Observation technique used by anthropologists).

This index can be suitably modified to quantify certain aspects such as decision – making on getting treatment for an illness or taking preventive measures to improve the health status.

75. FACTORS AFFECTING AGED POPULATION

L.K. SAMUEL AND J. RICHARD

Christian Medical College, Vellore.

The two fundamental processes which have a direct bearing on the population and age structure are fertility and mortality apart from migration. The age structure is determined more by fertility than by mortality in the absence of migration. However, there are a large number of factors which affect fertility and mortality and hence may directly or indirectly affect the proportion of persons in each age group. In this study, an attempt is made to examine the factors affecting the proportion of the aged in India. The data were collected from the Publication of Census Commissioner of India (1981), Sample Registration System and Population Reference Bureau. Step-wise Regression analysis was done to find out the combination of factors that explained the highest amount of variation and the total contribution of all the explanatory variables on the explained variable (Percent 60+). The results are presented and discussed.

76. "ANALYSIS OF FAMILIAL DATA"

RAJAVELU

University of Wisconsin

77. USE OF DATABASE IN BIG MENTAL HOSPITALS

SHIVAJI RAO, V.SHANMUGAM & V.G.KALIAPERUMAL

NIMHANS Bangalore.

The mental health delivrey system is being carried out by big mental hospitals situated mainly in big cities. Though the delivery system has slowly shifted towards smaller wards attached to hospitals run by medical colleges and community oriented mental health facilities, mental hospitals are still popular for treating mental patients and particularly for those who are severely mentally ill. In the Department of Biostatistics, National Institute of Mental Health & Neuro Sciences,Bangalore systematic database has been maintained for all those patients who were registered at the Out Patient Department with or without admission into inpatient services. Mainly the data includes socio-demographical, economical and diagnostic variables. The database which is a computerized one includes about six to seven thousand patients per year. The data available in the database for the period 1983 to 1989 (seven years data) are analysed. The results are presented and discussed.

78. CONTRACEPTIVE CHOICE AND FERTILITY REDUCTION: ROLE OF OPERATIONS RESEARCH

C. M. PANDEY

Sanjay Gandhi Post Graduate, Institute of Medical Sciences, Lucknow

With the advancement in contraceptive technology a variety of methods with varying efficiency are available to the users. Though it is conveneinnt to the user to adopt any method of his/her choice but on the other hand it becomes difficult to a service proivder, how to diefine targets, allocate resources and amount of effort for various methods to achieve the desired goal. In view of the importance of the objective and issues involved, ti has been a significant question often raised by the programme managers but seldom explicitly addressed.

Some of studies have reported that apart from other factors the choice of contraception is associated with the socio-demographic characteristics of the couple, the most important being the number of surviving children and/or the number of surviving male children. The present paper is an attempt to classify the couples according to above charectristic and to explore the use of operations research techniques in such problems. The objective is to maximise the total births averted under various constrains. A linear model has been suggested and the optimum number of couples recommended for various contraceptives is worked out using linear programming techniques.

79. TRACING THE ORIGIN OF CURRENT CONTROVERSIES OF APPLICABILITY OF INFERENTIAL METHODS — A CRITECAL REVIEW

K. V. SURYANARAYANAN

Andhra University, Visakapatnam

The philosophy behind science is to discover truth, the philosphy behind medicine is to use that truth for a patient, but the philospohy behind public health is to use that knowldege for everyone, for social justice.

What the significance tests (to compare baseline variables), actually assess, is the probability that the observed difference could have occurred by chance when in reality there was no difference. So far as epidemiolgical studies are concerned, in case an investigators, end results are not upto his expectations, a thorough check has to be made even from the stage of design-selection. However, it is alarming to notice (in published literature) epidemiologists tempting to attribute inconsistencies exclusively to use of significance tests. Hypothesis – tests on 'odds-ratios' are no exception.

From cost/time – considerations, observational studies have proved to be more appropirate (as compared to experimental studies), in resolving controversies on causation and association. If

one resorts to observational-studies, point/interval estimation procedures come into picture, because if there is causal-association, the immediate question is: "What is the precise estimated risk contributed by the presence of a risk-factor"?

Section–1 being introduction, in section–2, an indication is given that undestanding philosophical implications of causation (as applied to public health) can lead to remedy 'under -emphasis' and 'over-interpretation', tow major evils the work of epidemioligists is suffering from.

A whole range of controversies (starting from Greenberg to Holland) on causal inference are surveyed in this section. The major contributing factor is 'subjective judgement!. The pioneer Dr. Susser says "the determination of cause, ultimately, rests on subjective judgement".

The exact and approximate relationships between the 5 entities and their role in assessing 'ARE' and 'ARP' is the concern of section–3.

Starting from pessimism on 'irreconciliability' of null hypothesis (including sanctity of Walter's optimal sampling for significant relative-risks), this 4th section proceeds go compare Cox's and Cornfield's methods with that of Gart.

Scope for future research on 'regression-adjustment', 'multivariate' extensions of matching methods, etc., in the context of methods of reducing biases, forms subject matter of the last section of this paper.

80. SAFE MOTHERHOOD – A CHALLENGE TO THE WORKING WOMEN

A.L. LOBO, B.R. BHAT AND SUNITHA BHAT

Kasturba Medical College, Mangalore.

Education of mother is the most important social determinant of child survival. Half of the women in the developing countries are aneamic due to over work and too little food. Most women folk opt for work to support the family economically which doubles her work and responsibility. Females are fed last and least, multiple close pregnancies lead to malnutrition, leading to high maternal mortality and poor nutritional status of their infants. Basic elements of life style in the developing countries which contribute to poor health are the lack of clean water, safe sanitation, decent housing, basic education, employment and education in rural areas. Whereas urban areas with educated class modern methods of cooking and preserving food, lack of exercise, pollution – over crowding leads to poor health. The Present study highlights the problems of working women and constraints for safe motherhood. The status of working women in India has undergone considerable change but

the problems continued to remain unchanged. The health provider in the family is always a woman. She has to develop more skills in house keeping, cooking bringing up children and fulfilling the needs of housemates. The multifarious activities hardly give her time to think and plan. The average working hours for women is 15 to 16 hours both in home and office. This allows the women little time to think of health care and general wellbeing. If she is undernourished her children and malnourished and fall into chronic ailments. The health of the children is empowered on her and she has to prevent the disease and promote health.

Inspite of the awareness it is difficult to approach health centre due to lack of time. It is said that in oneway children of working mothers tend to become more indisciplined leading to juvenile deliquencies, on the other hand they become more independent, mature and full of initiative. The full time housewives tend to be over protective and dominating. The working mother neigther can leave her job nor can bring up the children without the support from others.

81. MATHEMATICAL MODELS ON MORTALITY IN MALARIA

S.K. MANDAL, MUKESH SRIVASTAVA AND M.P.S. NEPI

Biometry and Statistics Division, CDRI, Lucknow.

The mortality rate of malaria in Thailand has declined over the years from 1949 to 1985. This rate of decrease became asymptomatic in the later years. This date is based on time domain. Some time series models, emperical models and a mixture of time series and emperical models were fitted on the above data. The objective of the study was to find a suitable model which can fit the data well and could be used for forecasting. The identification of the best model was based upon residual analysis, autocorrelated errors and Akike Information Criteria.

82. SAMPLING PROCEDURE FOLLOW FOR A TUBERCULOSIS PREVALENCE SURVEY IN NORTH ARCOT DISTRICT

P.G. GOPI

TB Research Centre, Madras.

A Sample Survey was undertaken in North Aroct district to obtain the prevalence of

(a) Bacteriologically positive pulmonary TB
(b) Radiologically active abacillary cases, and
(c) Prevalence of infection in children below 10 years

The sample size was calculated as 89,000 to include both urban and rural sectors in the district. The projected population in 1989, when the survey started, was estimated from the 1971 and 1981

census population using an exponential growth curve. The village was decided upon as the sampling unit for the rural area. As stratification on population size was considered to be inappropriate and information on socio-economic status was not available in the sampling frame, stratification was based on Taluks. Thus, a stratified cluster sampling with proportional allocation was followed for the rural area.

The above method of stratified cluster sampling could not be followed for the urban area which contains 34 towns. A multistage samplping procedure was followed for the selection of the sample from the urban sector, the sampling unit being a street rather than a town or block. Unlike the village as the streetwise population was not available, the survey was undertaken following a random order of streets in each town until the required sample was obtained.

The prevalence of X-ray positive abacillary cases in the general population was estimated to about three times that of bacteriologically positive cases. Hence, one third of the sample was selected for X-ray examination to obtain an estimate of the prevalence of X-ray positive abacillary cases with the available sources.

The rationale of adopting different sampling methods, the assumptions used and the difficulties encountered, along with the solutions adopted and the formulae used for calculating the estimate of the prevalence and the standared error will be discussed.

83. LEVEL OF MORTALITY AND POPULATION GROWTH OF BANGLADESH

KASHEM SHAIKH AND MICHAEL A. STRONG

ICDDR, Bangladesh.

In this paper the level of mortality and growth of population in Bangladesh is discussed. Growth, or change in the size of population, is determined by three factors: births, deaths and migrations. The estimated population of Bangladesh from 1650 to 1981 has been shown and explanations offered for the changes which have occurred over the period. The estimated crude birth and death rates of Bangladesh from 1901 to 1987 are shown and discussed. The crude rate of natural increase, birth, death and major cuases of death of children during the period 1966–87 in a demographic surveillance area in rural Bangladesh are also presented. The birth rate remained more or less unchanged at a high level, the change in death rate accounting primarily for the change in the natural rate of population growth. Thus the fluctuating rate of the natural increase of the population, at a low level up until the 1941–1951 decade increased sharply to an alarmingly high rate since then. In and outmigrations also have an impart on population growth. During the 1941–1951 decade the net emigration from Bangladesh played an important role in holding down the rate of national population growth.

84. SOCIO-ECONOMIC AND DEMOGRAPHIC CORRELATES OF AGE AT MARRIAGE

R.P. SINGH AND RICHARD

Christian Medical College, Vellore.

The proposed research is based on data collected in a study carried out in rural and urban areas of North Aroct District of Tamil Nadu State. The objectives of the present research are to estimate the mean age at marriage by gender in rural and urban areas during 1985–88 and also to determine the association of age at marriage with specific socio-economic and demographic factors. The mean (S.D.) age at marriage of husband and wife in rural area were 26 (3.7) years and 18.6 (2.8) years respectively and in urban area 26.5 (3.9) years and 19.7 (3.4) years respectively, during the period. The variables, occupation, education and consanguinity were found to be associate with the age at marriage of husband and wife in both the areas.

85. NUPTIALITY AND EDUCATIONAL STATUS

R. P. SINGH

CMC Vellore–2

An important branch of demographic studies dealing with nuptiality analysis has special role with educational status of people. This research paper focuses attention on association of education level with their age at marriage and also on estimates mean age at marriage at each education level. The data was collected from rural and urban areas of North Arcot District of Tamil Nadu State during 1985–88, and is a part of a project on "Determinants of female age at marriage". A significant ($< .001$) association was found between age at marriage and educational status of both husbands and wives in both areas. The aestimated mean age at marriage were highest for education with Degree and above, and lowest for non-educational group.

86. NORTH ARCOT DISTRICT HEALTH IMFORMATION SYSTEM

V. BALRAJ, T. JACOB JOHN, R. SAMUEL AND M. SATHISH

CMC Vellore–4.

In India Today, the systems that report vaccination coverage for EPI (UIP) vaccines are we developed. However, systems to document the incidence of EPI diseases are poorly developed. We believed that linking-up private hospitals and clinics into a network that reports cases was possible and that this would augment the surveillance reports filed by Government Hospitals and Primary

Health Centres to a great extent. Such an augmented report could then be used for monitering EPI diseases in a specified population. The evolution of such a system, its role in a district and the cost implications are discussed.

87. INFORMATION SYSTEMS ON DRUG REACTIONS AND DRUG USAGE IN THE COMMUNITY

MOLLY THOMAS
CMCH, Vellore.

Though Pharmaceuticals play a major role in health care delivery, drug information systems are poorly developed.

We started in 1983 an Adverse Drug Reaction Monitoring Centre in Christian Medical College Hospital and extended its actvity from the hospital to the community collecting ADR reports from general practitioners in an organised manner using an internationally accepted questionnaire. The information received was useful in studying ADRs, trends, in prescribing patterns, use of inappropriate medications and drug combinations and prevalence of prescribing of banned and bannable drugs. Some examples will be discussed.

With time, coumulative computerised storage and retrieval of the incoming data and literature survey have provided the basis for a drug information service that is of value to the hospital staff and to others seeking information on durg reactions and interactions.

Based on these experiences we have undertaken drug utilisation studies among target populations such as pregant n women and for specific diseases and drug groups.

A prospective sutdy of 264 pregnant women attending an antenatal clinic showed that maximal drug prescribing was from private practitioners and nursing homes during all three trimesters of pregnancy in contrast to a teaching hospital.

57% of those who had been to general practitioners during various semesters of pregna ncy were given some durg whereas of those attending a teaching hospital antenatal service, only 24·6% received any drug. Contrary to the reports that self prescribing is high, it was observed only in 5.6% of patients. Self prescribing was maximal during 1st trimester and least during 3rd trimester.

First trimester prescribing was maximal from general practice. The commonest groups of drugs prescribed were hormones (19.2%), whereas from teaching hospital it was only 6.2%. In the teaching hospital, the indications for use of hormones were more appropriate compared to general practice. Antibiotics use was 7.6% from general practice whereas nil from the teaching hospital; antipyretic analgesic was 7.7% in general practice as against 1% from the teaching hospital. No significant drug related problems were noticed in this study.

Studies on drug use in puerperium on 306 women showed antibiotics were given in 20% of all normal, 40% of forceps and 96% of caeserian deliveries. Though the indications were appropriate in all instances, a few cases the duration of treatment was inappropriate. Almost all the women had routine vitamin and mineral suppliments.

Most patients did not have any clear iideas to the use of drug during preganancy and its possible effect on mother and fetus. Attitudes of pregannt women to drugs during pregannncy and lactation showed more than 1/3 of the women were unsure about the use of drugs in pregnancy whereas about 50% of women felt it unsafe for the baby if medicines are tiaken during pregnancy.

There is over-prescribing during pregnancy especially in general practice and hence it is essential to health educate the target population and the physicians about drug usuage.

88. SURVEILLANCE OF VITAL EVENTS IN RUHSA PROGRAMME

RAJARATNAM ABEL, S.G. VICTOR, K. CHAKRAVARTHI,
AND JOLLY RAJARATHNAM

RUHSA, CMCH, Vellore.

Birth, deaths, marriages and other vital events are routinely recorded as part of the RUHSA Programme activity. Family Care Volunteers (FCV) who are the Primary Health Care Workers of RUHSA obtain the information during their routine field visits. Each week they pass this information on the Health Aide, the female Health Worker.

The Health Aides along with the Rural Community Officers consolidate the report of 5–7 FCV of each Peripheral Service Unit (PSU) and pass it on to the Central Service Unit (CSU) as a weekly report.

The weekly reports for 18 PSUs are entered into computer and consolidated as a monthly report and sent back to each PSU to verify the computerised data.

Periodically this data is verified by a different team of workers. Correction as necessary is carried out and feed back is provided to the field level functionaries. Constant efforts are made to improve the accuracy of the data.

AUTHOR INDEX

Name	Excerpts No.
Agarwal S.S.	47
Agarwal O. P.	21
Aiyanna B.M.	60, 61
Amarjit Singh Bhartia	25
Andrew Foster	67
Anil Kumar	3
Anil Mathew C.	58
Arora Y.L.	69
Ashok Segal	42, 45, 47
Atul Juneja	42
Aziz K.M.A.	64
Badole C.M.	36
Bagavandas M.	52
Balakrishna N.	20, 57
Balraj V.	86
Bharambe M. S.	35, 36
Bhardwaj S.D.	32
Bhat B.R.	80
Biswanath Mukherjee	25
Bogdanwojtyniak	67
Chakravarthy K.	88
Chandrasekar A.	55
Chodankar V.P.	33
Chowdhury A. I.	64
Devaraj K.	72
Dube K. C.	22
Dwivedi S.N.	4, 8
Dwivedi M. P.	4, 8
Ezhil R.	7
Ganapathy K.	48
Ganguly S. S.	30
Ghuliani K.K.	35
Giribala Kshirsagar	50
Goel A.	71
Gokarn A.G.	61
Golam Mostafa Md.	67
Gopalakrishnan R.	58
Gopi P.G.	82
Govindaraju S.	48
Govindaraju R.	52
Grace Mariya Augustine	9
Grover D. K.	39, 40
Grover I.	39, 40
Gupta R. K.	2
Gupta T. C.	28
Gupta B.N.	24
Gupta H.D.	11
Indrayan A.	21
Irudhya Rajan S.	70
Jacob John T.	86
Jayabal P.	12
Jayasri R.	13
Jeyaseelan L.	27
Jolly Rajaratnam	88
Joseph Alexander E.	56
Kachirayan M.	9, 34
Kaliaperumal V. G.	77
Kambo Indra P.	46
Kannan A. T.	21
Kashem Shaikh	83
Kaul K. K.	54
Kishore Kumar B.	10
Kotian M. S.	37
Krishna D.	49
Krishnamoorthy S.	72
Kulkarni P. M.	72
Kuruvilla B.	54, 63
Lakshman M.	51
Lamba I. M. S.	5
Lobo	80
Lokkywai V.	68
Luthra U. K.	31, 42, 44, 45, 47
Mandal S. K.	24, 81
Mathur N.	24
Menon S.	22
Michael A. Strong	83
Mishra R. N.	32, 38
Mishra U. S.	65
Molly Philip	37, 41
Molly Thomas	87
Mukesh Srivastava	24, 81
Murthy B. N.	7, 12
Murthy N. S.	31, 42, 44, 45, 47
Nair N. G. K.	13, 59
Nair N. S. K.	14
Narang P.	50
Narayanan T. R.	48
Narender Kumar	22
Natarajan V. P.	73
Navaneetham K.	70

Name	Excerpts No.
Nayar S.	50
Negi M. P. S.	81
Narayanan T. R.	48
Nurul Alam	68
Padam Singh	19, 69
Padma Mohanan	41
Padmavathy M.	51
Panday A.	65
Pandey G. D.	66, 71
Pandey C. M.	78
Parhee R.	22
Pathak K. B.	65
Periannan V.	9, 34
Prabhakar A. K.	22
Prabhakar R.	15, 17
Radhakrishna S.	7, 12
Raj Velu	76
Raja Ratnam Abel	88
Rajkumar S.	22
Rao P. S. S.	18, 23, 51, 53, 56, 62, 63, 74
Reddy P. J.	49
Richard J.	22, 62, 63, 74, 75, 84
Sabiha Sultana M.	52
Saiprasad G. S.	60, 61
Samuel L. K.	27, 75
Samuel R.	86
Santhosh	37
Saravanbavan V.	26
Sarita Sardana	47
Satacopan M. C.	10
Sathish M.	86
Satyanarayana L.	31, 42, 45
Sehgal A.	31, 44
Selvaraj V.	10, 34
Selvaraj K. G.	23, 73
Sethi B. B.	22
Shanmuganandan S.	26, 29
Shanmugam B.	77
Sharma O. P.	14
Sharma K. C.	44
Sharma T. N.	11
Shashi Sharma	42, 44, 47
Shivaji Rao	77
Singh A. S.	32
Singh R. P.	84, 85
Sircar P. K.	6
Sirumban P.	18
Somasundaram P. R.	16
Soans T.	37
Somasundaram P. R.	16
Subramanyam K. N.	53
Sundaramoorthy L.	9
Sumitha Bhat	80
Suriya Narayanan K. V.	79
Thangaraja Joseph R.	9, 34
Thimmayamma B. V. S.	57
Thomas Chacko V.	58
Thomas Vengail Chacko	1
Tiwari I. C.	38
Tyagi N. K.	35, 36, 50
Vasna Pushparaj	9, 34
Venkatasubramanian S.	7
Venkatesan P.	15, 16, 17
Verghese A.	22
Verma A.	71
Victor S. G.	88
Vincent Fauveau	64, 67
Virudhagirinathan B.	52
Viswanathan K.	15, 17
Visweshwara Rao K.	20, 49, 57
Yadav R. J.	19
Yeole B. B.	43

With best compliments from

Tel : (0413) 25855, Tlx : 0469-272 ADPS-IN, Fax : (91) 413-23467

AURELEC DATA PROCESSING SYSTEMS

PRAYOGASHALA - AUROVILLE,
KOTTAKUPPAM-605 104
TAMIL NADU, INDIA

BRANCHES :

- BANGALORE-560 025 : 1st Floor, 134/1, Brigade Road,
  Tel : (0812) 215393 P.P., Telex : 0845-2031 ADPS IN
- CALICUT-673 001 : M.S.S. Cultural Complex, Cherooty Road,
  Tel : (0495) 74936, Telex : 0804-295 ADPS IN
- COCHIN-682 031 : Ernakulam, 4th FL. Kannankeri Estate, Shanmugam Road, (Marine Drive) Tel : (0484) 361960, Telex : 0885-6784 ADPS IN
- COIMBATORE-641 018 : 8/4, Race Course,
  Tel : (0422) 22085, Telex : 0855-484 ADPS IN
- MADRAS-600 015 : Archana Centre, 29, Mount Road,
  Tel : (044) 418051, Telex : 041-21008 ADPS IN
- MADURAI-625 009 : 85-F. Kamarajar Salai,
  Tel : (0452) 37858, Telex : 0445-349 ADPS IN
- PONDICHERRY-605 011 : 59, Ilango Nagar,
  Tel : (0413) 24853, Telex : 0469-222 ADPS IN
- TRIVANDRUM-695 001 : C/o. Datamen Consultants Pvt. Ltd.,
  XXVIII/277 Madhura Bhavan, Pulimood Junction,
  Telex : 0435-428 ADPS IN
- TIRUCHIRAPALLI-620 001 : 34, Raja Colony, Colletor Office Road,
  Tel : (0431) 41268, Telex : 0455-304 ADPS IN

A unit of Aurelec Trust Research and Development Laboratory recognised by the Government of India

With best compliments from

☆

Phone : 20343

DICKINSON & CO.,

Dealers : ALL LATEST TYPES OF STEEL AND WOODEN FURNITURE.

☆

23, Officers Line,
VELLORE-1 (N. A. A. Dt.)

With best compliments from

TEL : Off : 23923
Resi : 27923

PANJU
TOURIST & TAXI SERVICE
(Regd.)

M. C. PANCHATCHARAM

40/3, Katpadi Road,
(Upstair)
Vellore-632004

With best compliments from

NUTRINE CONFECTIONERY COMPANY LIMITED

Manufacturers of India's Largest Selling Sweets & Toffees

P. B. No. 38, BVR Colony,
CHITTOOR-517 001 (A.P.)

For Your

* Proper, perfect and prompt tax planning
* Early compliance of Income tax provisions
* To get your refund of Income tax processed
* Better investment-cum-tax planning :

CONTACT :

Phone : 22496 with Extn.

K.R. SAMPATHRADHAKRISHNAN & CO.
Income-tax Practitioners

27, Periyadanam Subraya Mudali St.,
Velapadi, Vellore, (N.A.A.Dt.

With best compliments from

Phone : 4503

Visit

G. B.

For Quality Bakery Items

GREATEST BAKERY

Court Road, NAGERCOIL

With best compliments from

Estd : 1937 Phone : 20084 & 21084

THE VELLORE RADIO HOUSE

Radio & Electrical Dealers
Sales and Service

P. O. Box No. 130,
Officers' Line,
VELLORE-632001

With best compliments from
Phone : 855 41 61, 86 80 79

Vora Book Centre

(A Medical Book House)

Dealers in :

Medical, Dental, Nursing & Pharmacy Books,
Wholesalers, Retailers and Library Suppliers

☆

Post Box No. 3293,
6, Princess Building,
Near J. J. Hospital Signal,
Ebrahim Rahimtulla Road,
BOMBAY-400 003.

With best compliments from

Phones : 21646 & 23928
Grams : FAIRDEAL

VICTORY AGENCIES

7/1, Beri Bakkali Street,
VELLORE-632 004

☆

Authorised Stockists :

L & T : Switchgear Standard Products
MDS : Miniature Circuit Breakers
SUGUNA : Electric Motors & Pumpsets

OUR PUBLICATIONS IN STATISTICS

Statistical Methods, S. P. Gupta, Rs. 90
Elementary Statistical Methods, S. P. Gupta, Rs. 47-50
Indian Statistics, S. P. Gupta, Rs. 15.
Revisionary Exercises in Statistics, S. P. Gupta, Rs. 15.
Objective Type Questions in Statistics, S. P. Gupta, Rs. 6-75
Business Statistics, Gupta & Gupta, Rs. 60.
Problems & Solutions in Statistics, V. K. Kapoor, Rs. 75.
Statistics, Sancheti & Kapoor, Rs. 95.
Operations Research & Statistical Analysis, Gupta & Man Mohan, Rs. 88
Fundamentals of Mathematical Statistics, Gupta & Kapoor, Rs. 65.
Fundamentals of Applied Statistics, Gupta & Kapoor, Rs. 45.
Elements of Mathematical Statistics, Gupta & Kapoor, Rs. 27-50
Practical Statistics, Shiv Kumar, Rs. 55.

PLEASE Order with advance 20% and write for detailed catalogue.

SULTAN CHAND & SONS

Educational Publishers

23, Darya Ganj, New Delhi.

With best compliments from

A. H. Press

VELLORE-632 004

With best compliments from :

KHANDELWAL LABORATORIES LTD.,

PARTICIPANTS IN THE PROGRESS OF MODERN MEDICINE
THE PIONEERS IN THE FIELD OF ANTICANCER DRUGS

☆

Registered Office :

79/87, D. Lad Path, BOMBAY-400033

With best compliments from

Phone : 455294

BESTRON ENGINEERING ENTERPRISES

Contact for your requirements of

— Computer
— Computer Hardware / Software
— Computer Stationery / Pre-printed forms / Files etc.,
— Dot Matrix Printers
— HP Laser Printers
— UPS / Servo Stabilizer / Spike Buster / Line Filter
— Printer Sharer Switch
— Cannon Xerox Machine
— Thakral-Casio Calculators
— AMC for Computers,
— Etc.,

116, Eldams Road, Teynampet
MADRAS-600 018

With best compliments from :

Telephone : 566164
566530

Telegram : 'THORACIC'
Telex : 041 6240 VSEC IN

FAX : 91–44–561959 Vishal Madras India

Vishal Surgical Equipment Co.

Manufacturers & Stockists of :

Surgical Instruments, Equipments & Implants for Otolaryngologists

☆

Distributors for :

1. M/s. Willy Rusch / West Germany
2. ,, Karl Storz / West Germany
3. ,, Martin / West Germany
4. ,, Richard Wolf / West Germany
5. ,, Portex Ltd. / U.K.
6. Cook South East Asia P Ltd / Singapore
7. Eschmann Bros. & Waish Ltd. / J.K. (Health Care Dvn.)
8. Stryker International / USA
9. C. R. Bard International / USA
10. Maico Hearing Instruments / USA
11. Codmann & Schurtleff / USA

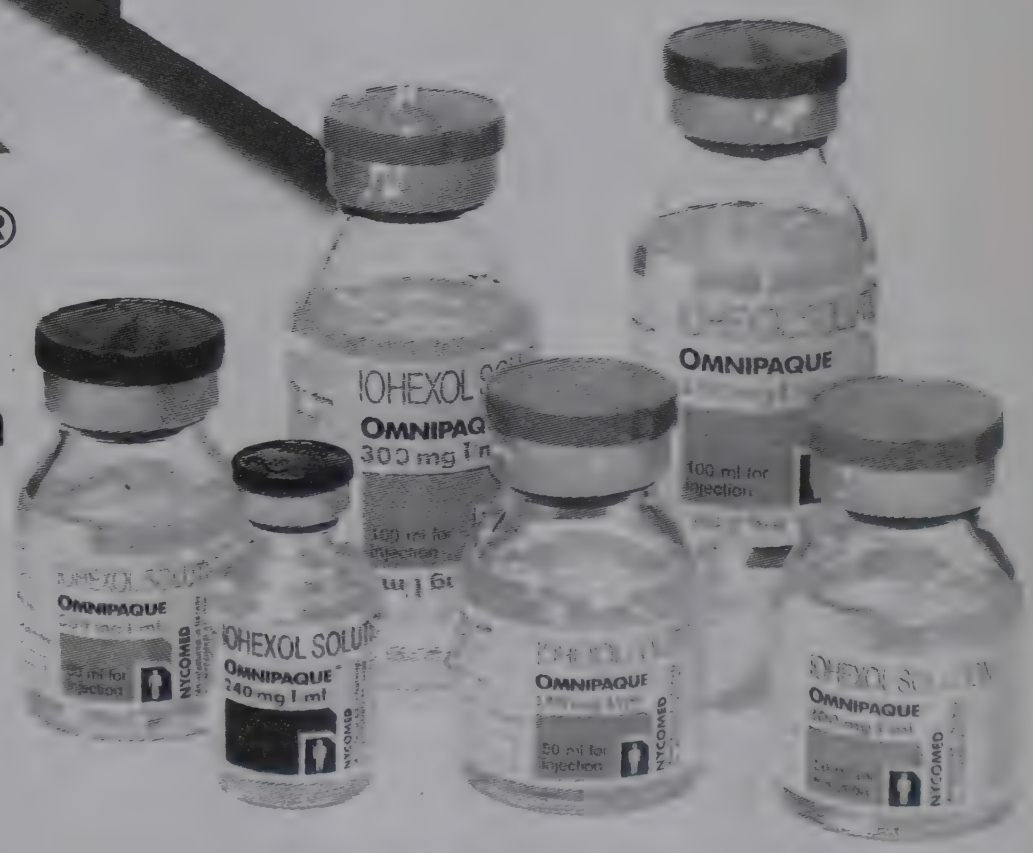
17/4, Narasingapuram Street, Mount Road,
MADRAS-600002

Patient Safety and Tolerance lies in your hands –

The choice is yours.

Also for Vascular Indications:

- CT-enhancement
- Cardioangiography
- Cerebral angiography
- Renal, Visceral and Peripheral arteriography
- I. V. Urography
- Phlebography
- Paediatric use



OMNIPAQUE®

IOHEXOL

Non-ionic contrast medium

Presentations for vascular use:

140 mg I/ml	50 ml and 200 ml
240 mg I/ml	20,50 and 200 ml
300 mg I/ml	20,50 and 100 ml
350 mg I/ml	20,50 and 100 ml

Our importers and stockists will contact you for your requirements.

For detailed information and literature, please contact:

NYCOMED

NYCOMED MEDICAL SERVICES
P.O.Box 4283,
Bangalore – 560 042

Christian Medical College, Vellore

Course Leading to M.Sc. Degree in Biostatistics

An M.Sc. course in Biostatistics was started at the Christian Medical College, Vellore, in June 1986. The course includes necessary mathematical theory and applications of biostatistical techniques. The qualification for admission is : B.Sc degree in Statistics or in Mathematics, with Statistics which is recognized by the University of Madras. At the successful completion of the course, the M.Sc. degree will be awarded by the University of Madras.

The course covers : Linear Algebra ; Theory of Probability ; Distributions — Theory and Applications ; Research Designs and Data Processing ; Demography and Health Statistics ; Applied Biostatistical Inferenee; Epidemiologic Methods ; and Health Services Research. Apart from these courses, a candidate has to select two optional papers during the second year of the course ; currently, the optional papers offered are (1) Applied Operations Research ; (2) Population Genetics and Bioassay.

More details can be had from :

Registrar, Christian Medical College, Vellore-632 002.

With best compliments from

☆

"THE TASK OF THE ENLIGHTENED IS TO REMOVE THE POVERTY, THE INEQUALITY, THE INDIGNITY AND THE SUFFERING WHICH WEIGHS DOWN COUNTLESS MILLIONS IN THIS WORLD "

— Dr. S. Radhakrishnan

☆

Space Donated by :

FASHION HOME

GODREJ WHOLESALE DEALERS

2/5, Officers Line,
VELLORE-632 001

B. I. PUBLICATIONS announces the latest arrivals of books on
BIOSTATISTICS :

LITTLE BROWN

Author	Title	Price
Colton	STATISTICS IN MEDICINE	$ 27.50
Hennekens	EPIDEMIOLOGY IN MEDICINE	$ 19.95
Leaverton	A REVIEW OF BIOSTATISTICS, 3/edn.	$ 14.95
Riegelman	STUDYING A STUDY AND TESTING A TEST : HOW TO READ THE MEDICAL LITERATURE, 2/edn.	$ 21.50
Sackett	CLINICAL EPIDEMIOLOGY : A BASIC SCIENCE FOR CLINICAL MEDICINE	$ 26.50

CHURCHILL LIVINGSTONE

CHURCHILL'S MEDICAL DICTIONARY, 1989 edition £ 19.95

Contact your nearest Medical Bookseller or write for your requirements to

Phone : 861851, 869361

B. I. PUBLICATIONS PVT LTD.,

9/10, Agurchand Mansion, 150, Mount Road, MADRAS-600 002

Best compliments from :

electronics & controls

31/2, 4th Main Road,
Gandhi Nagar, Adyar,
MADRAS-600 020
Phone : 412635

With best compliments from

Britannia Industries Limited

BANGALORE ☆ BOMBAY

CALCUTTA ☆ DELHI ☆ MADRAS

With best compliments from :

Tel : 642992 Telex : 0845-8483 MOOL IN Cable : MOOLAASTAR

Moolaa Tools Private Limited

H. O. 1381, South End Main Road,
9th Block East, Jayanagar,
BANGALORE-560069. India